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CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

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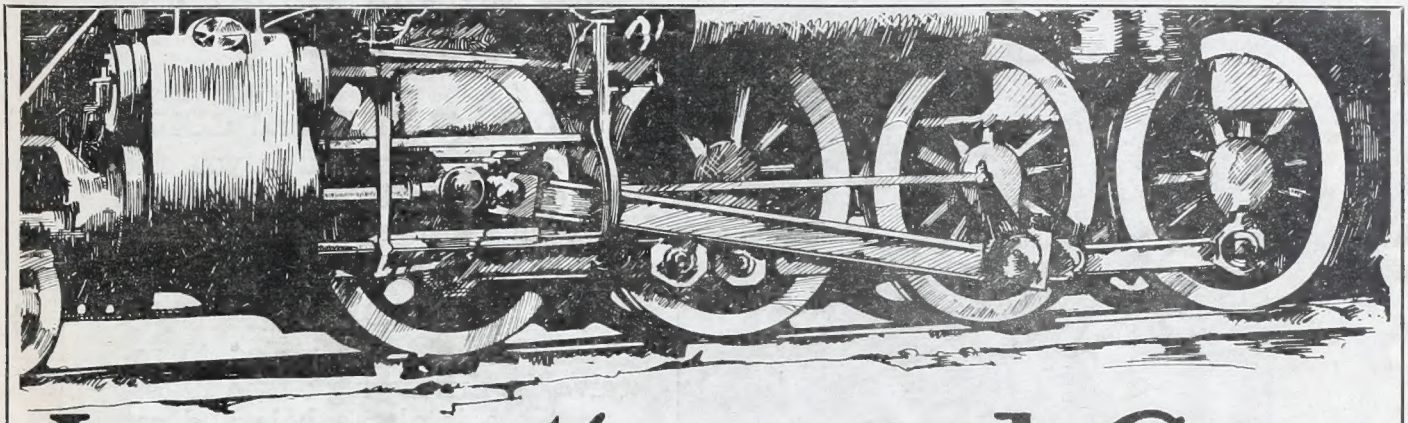

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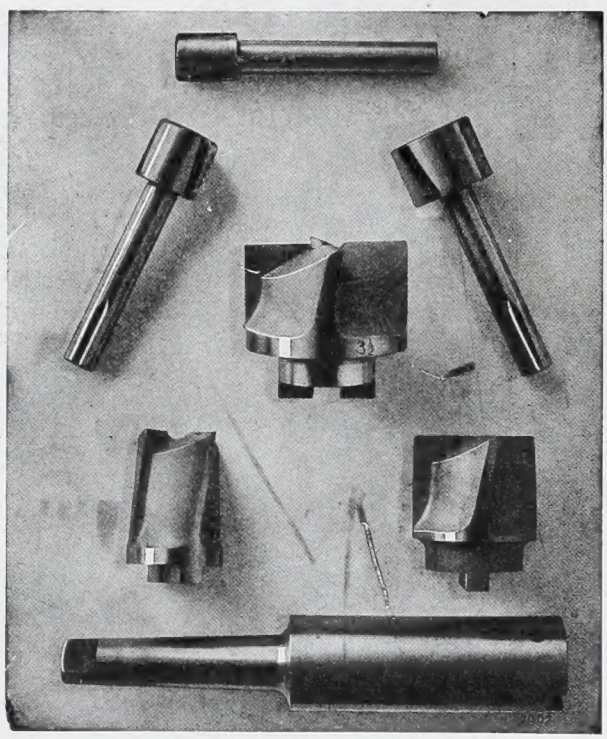

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With this combination you can immediately make the right combination for every counterboring job.

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The shank of the guide passes through the hole in the cutter and the shoulder between the guide and its shank keeps the cutter in place. Cutters can be sharpened on the face, and the guide is simply pushed further in the hole after grinding.

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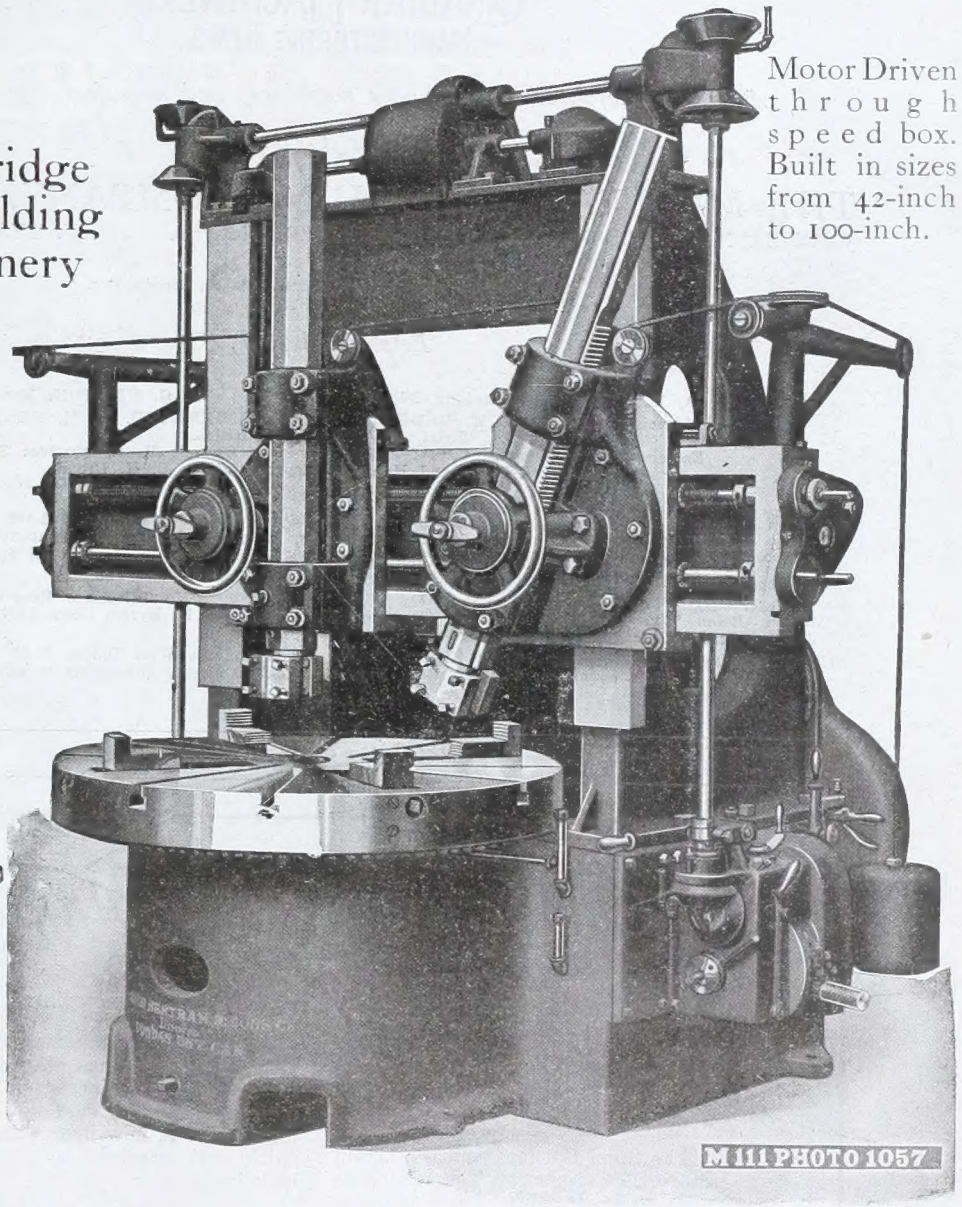

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The Publisher's Page

CANADIAN MACHINERY
AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

Published by

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Vol. XXII. TORONTO, JULY 3, 1919. No. 1

Competition and Volume

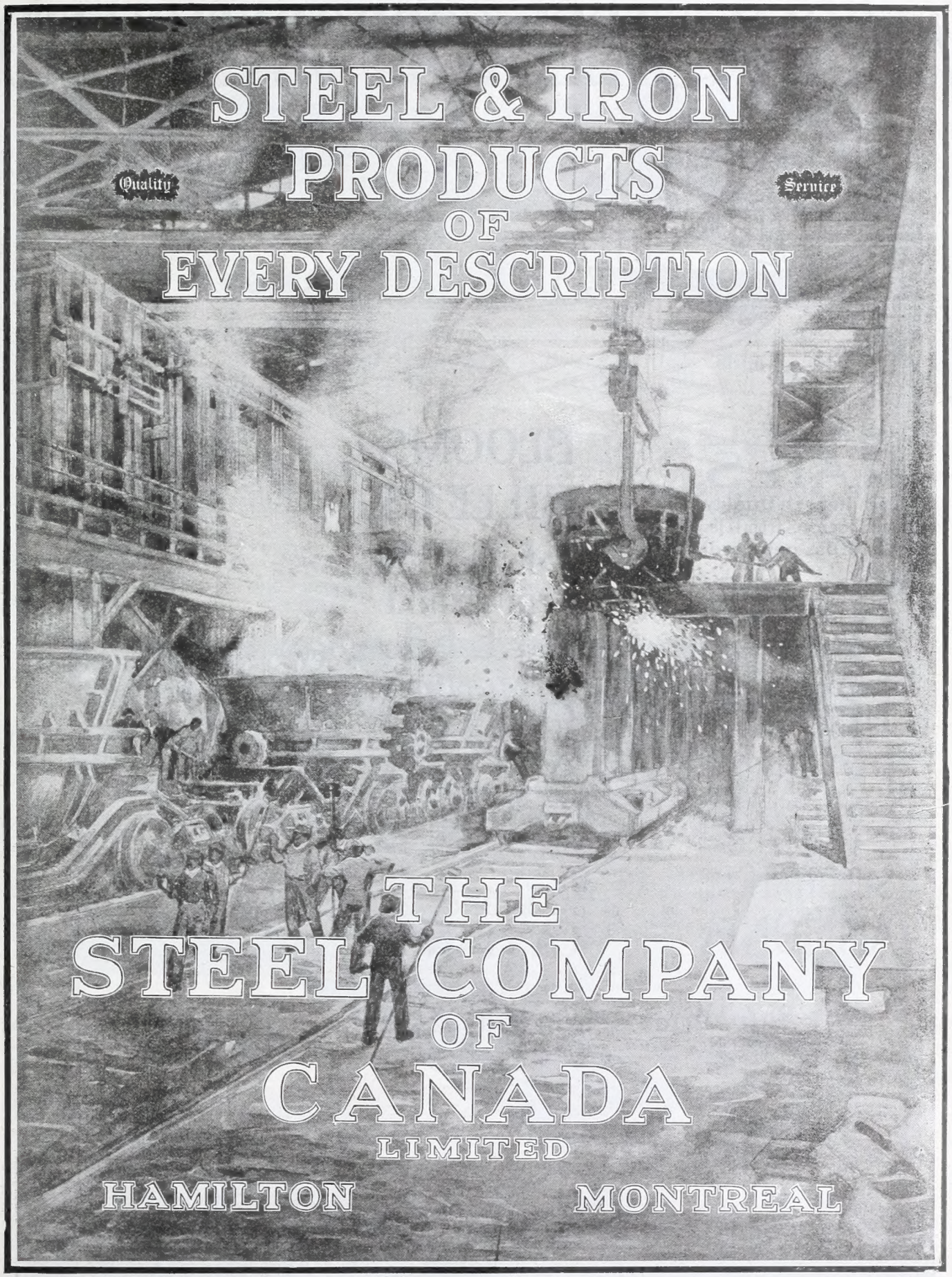
THE big four of thirty years ago in the packing industry is not the same big four of to-day. A new firm took the place of one of the old. Yet at the time the big four were supposed to be a monopoly.

The Steel Corporation, the Chain Store, The American Tobacco Company, The Standard Oil Company, all were supposed to be dangerous because combination would allow them to advance prices, make big profits and throttle competition. The dire results predicted never followed. In each field competitors have profited by volume of trade, and a small profit has proved better business economics than small volume and big margin.

In this transformation of business, advertising has played a most important part. Increased demand increases volume and lowers the unit cost. A new firm with vision, faith and capital, always has a look in.

Competition has been theoretically killed many a time in the fears of some people by monopoly. Nothing can kill it in practice except state socialism or the new and better theory of co-operative advertising and lowering the unit cost.—"Printers' Ink."

Canadian Machinery and Manufacturing News, July 3rd, 1919. Vol. 22, No. 1. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3.00; United States, $3.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.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This Betts Planer has been in active service 16 years, part of the time on 24-hour duty and continues to perform accurately and faithfully on a wide range of duties. Long life and faithful service are characteristic of all Betts tools because they are built to render service—not to sell at a price.

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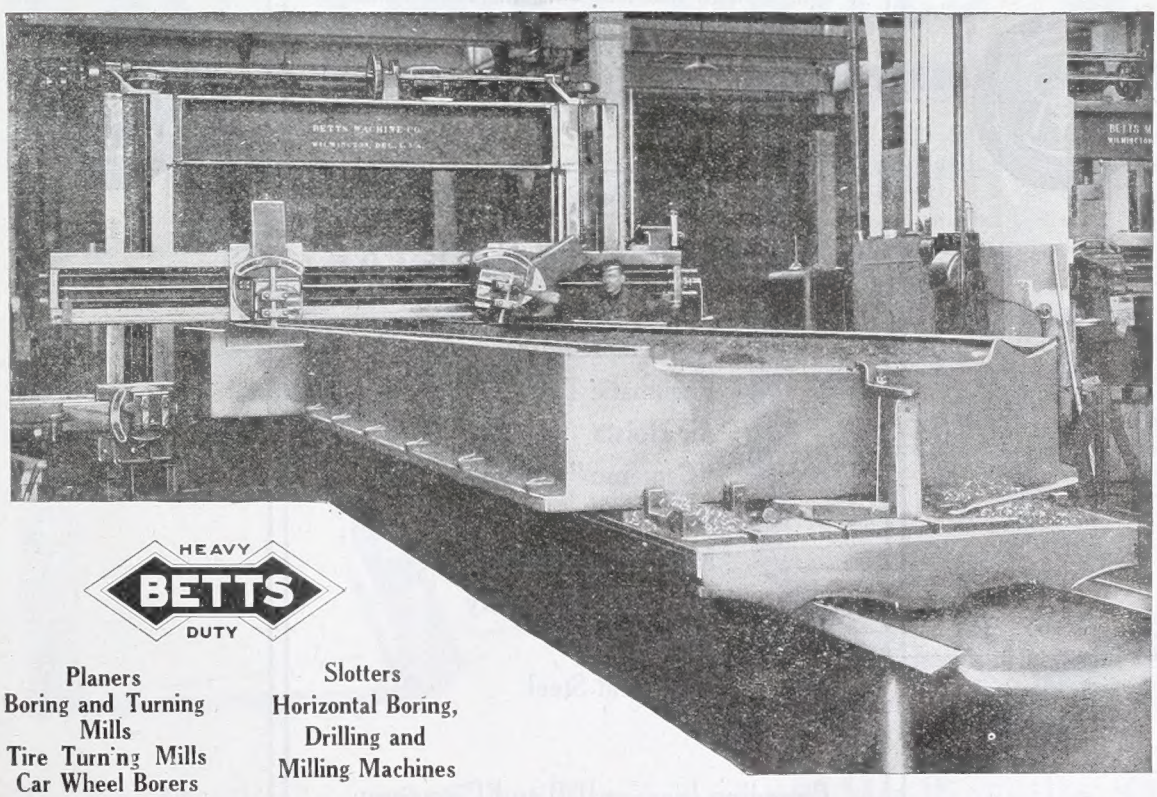

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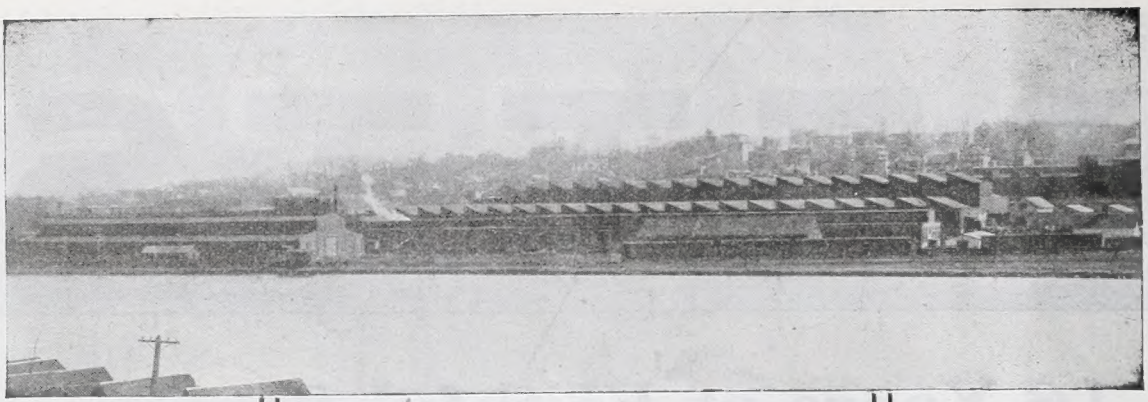

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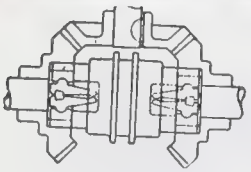
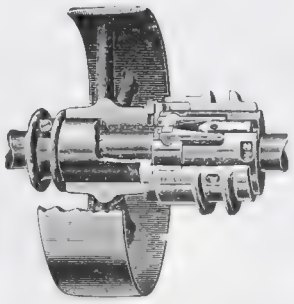


DOUBLE CLUTCH
IN NEST OF GEARING



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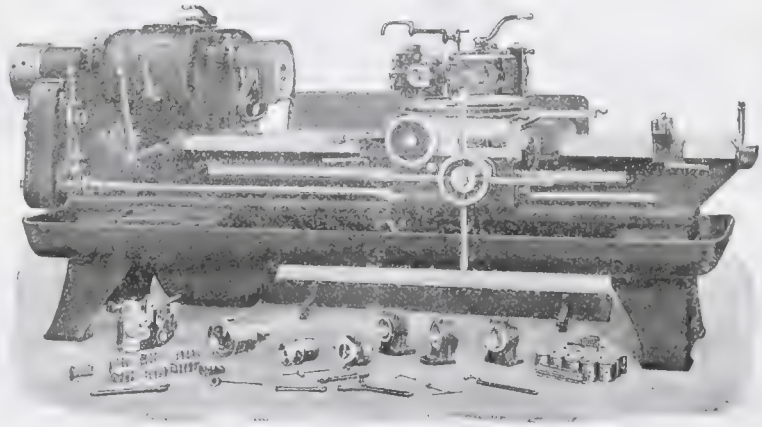

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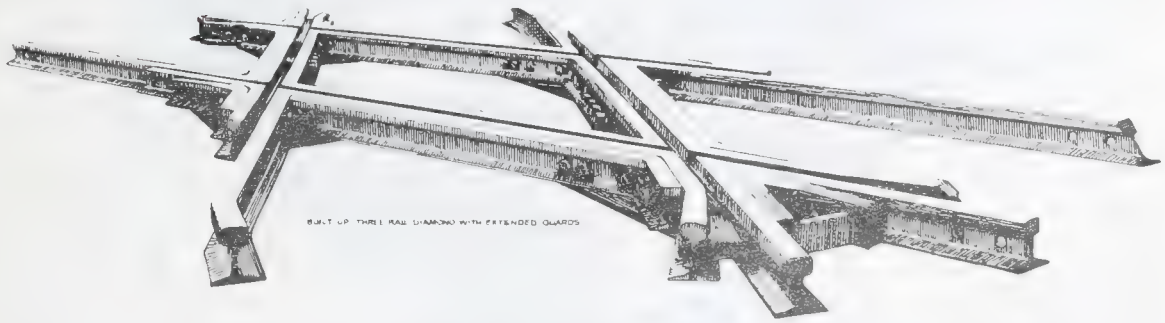

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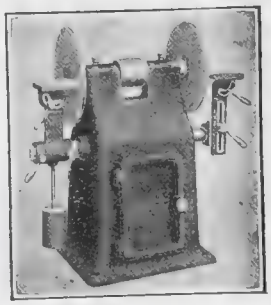

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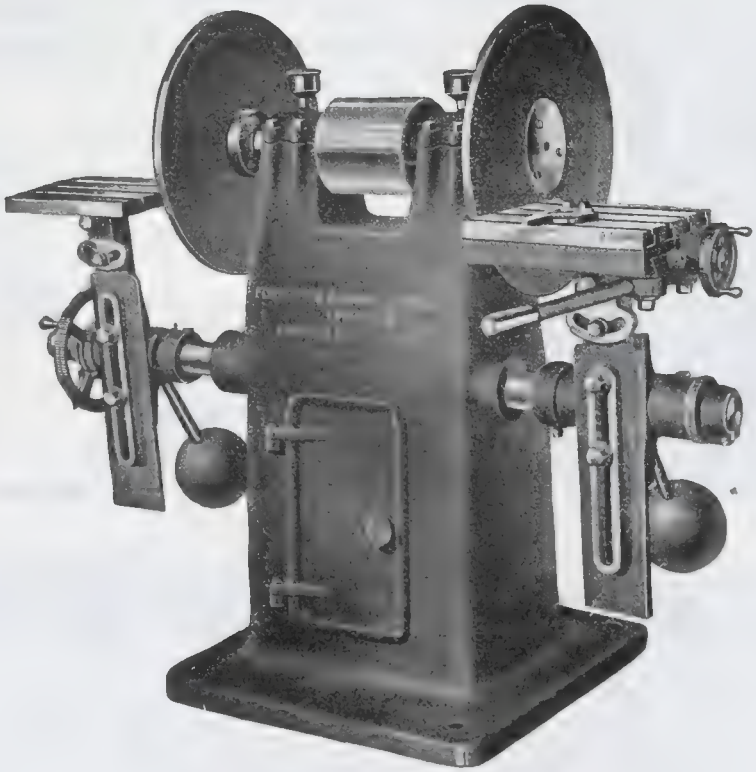

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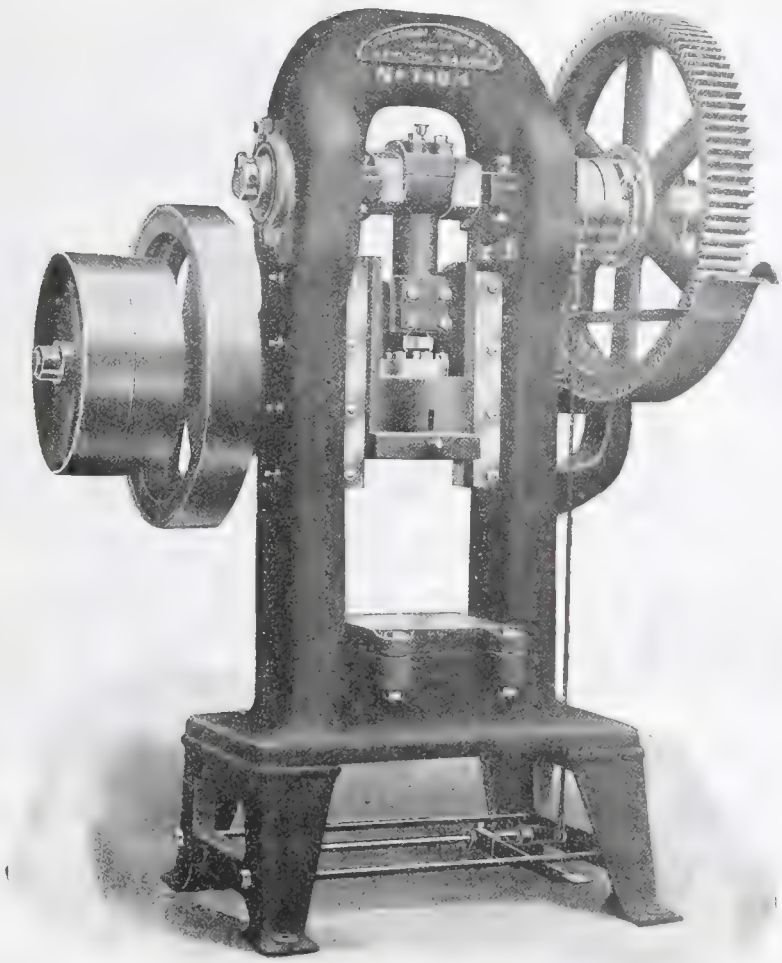

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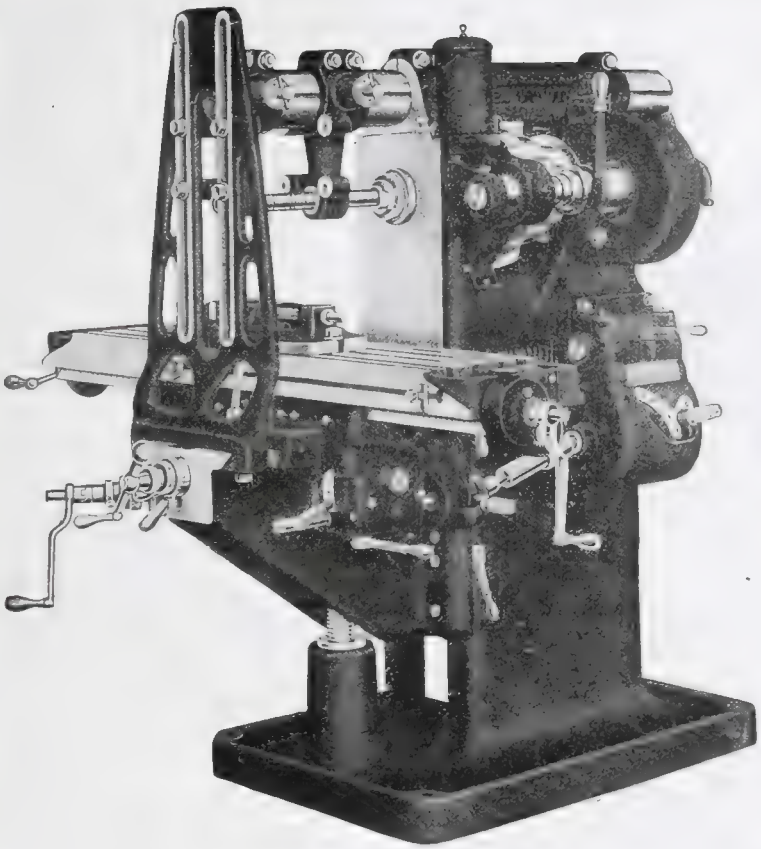

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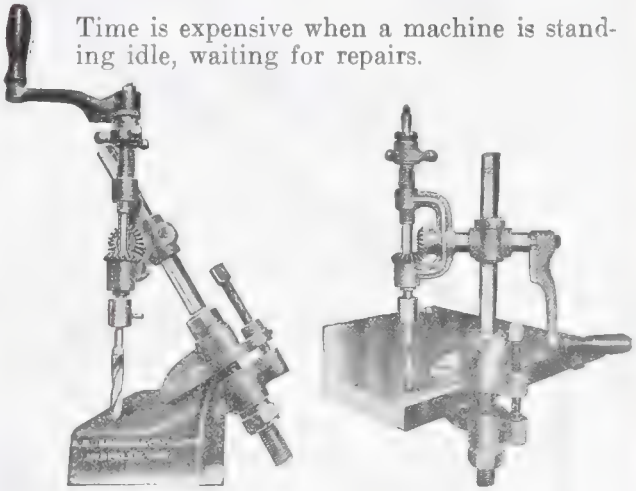

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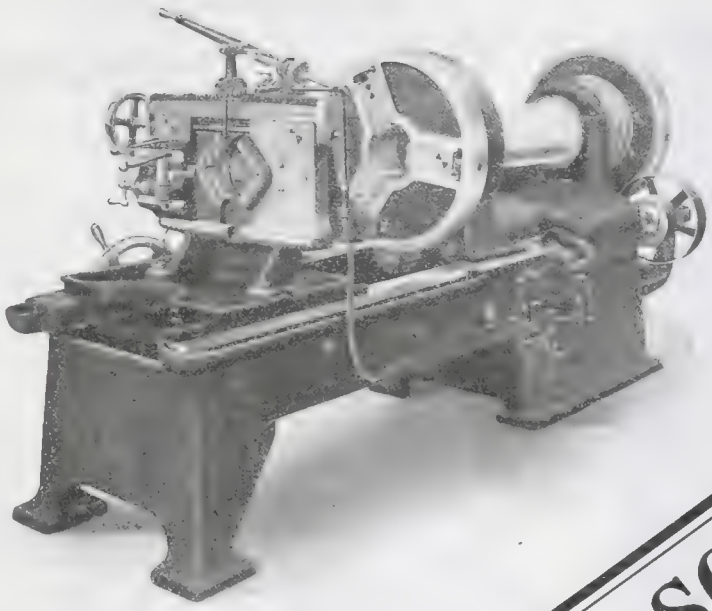

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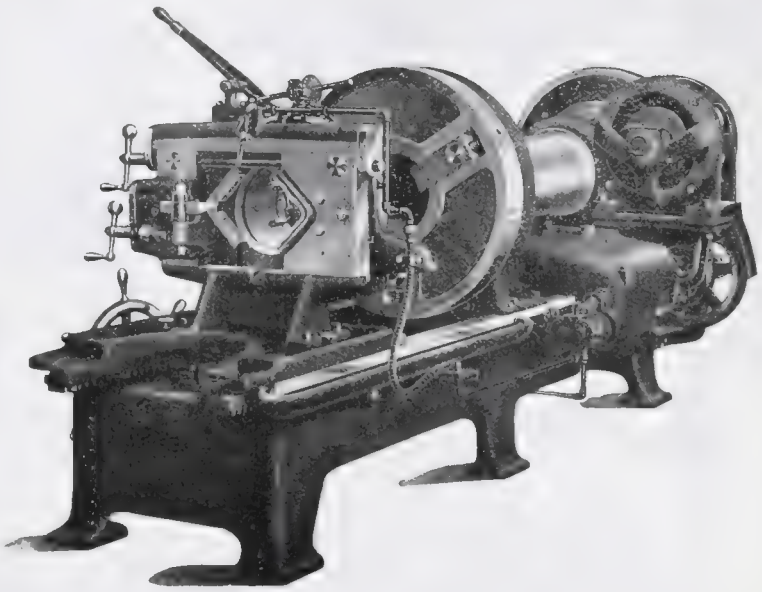

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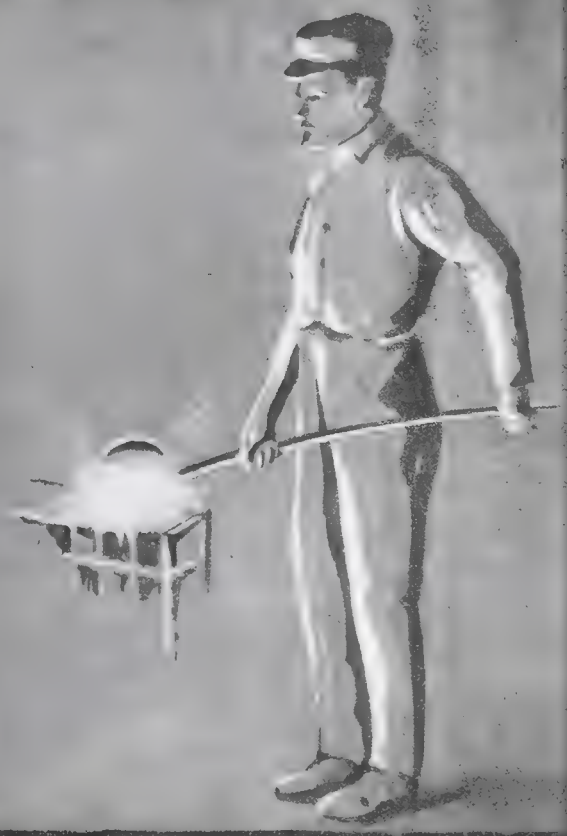

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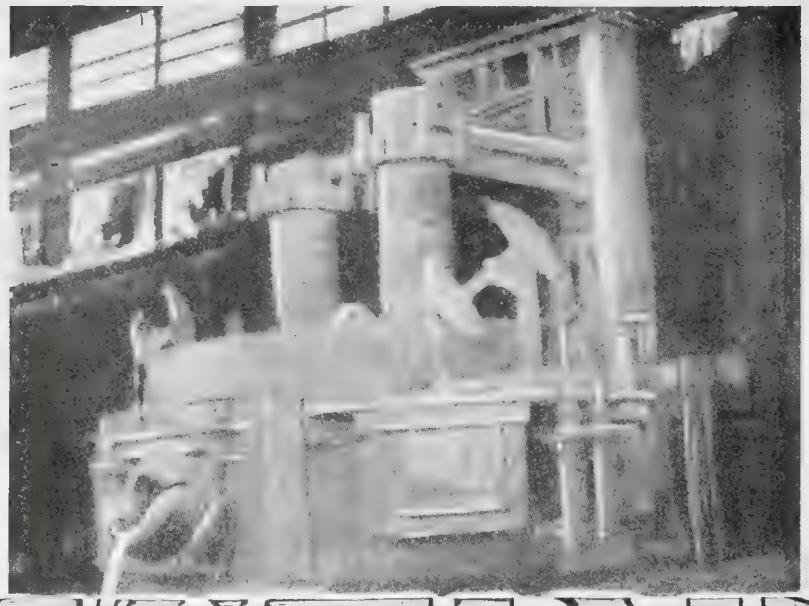

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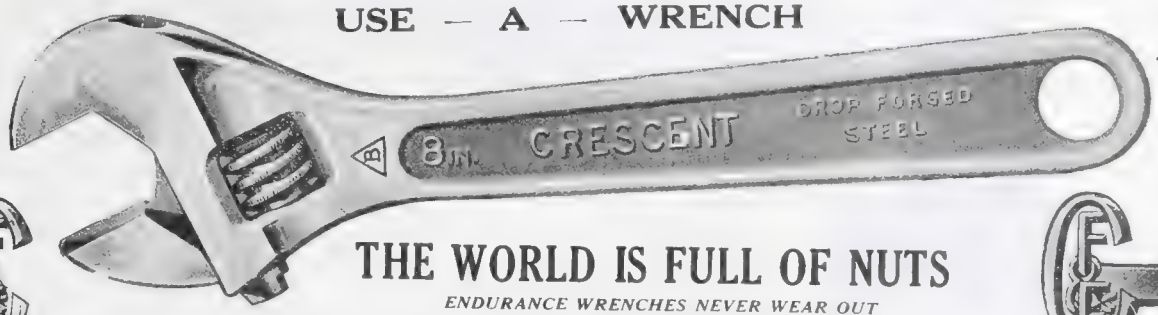

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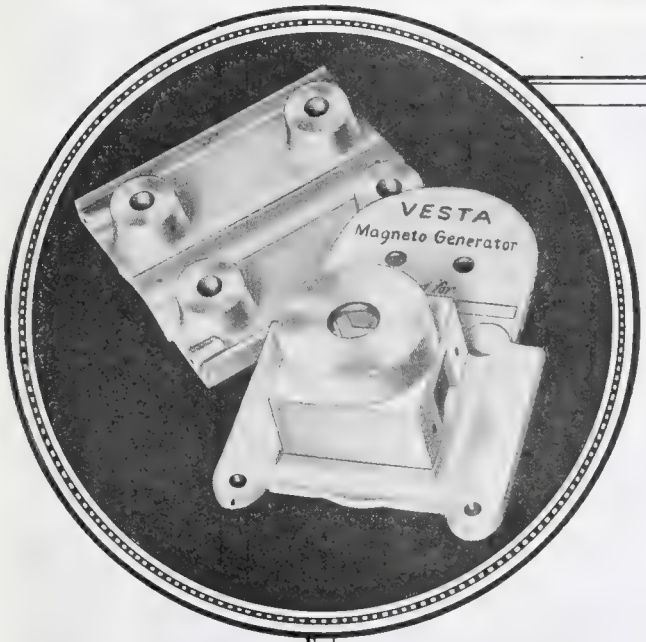
ENDURANCE WRENCHES NEVER WEAR OUT
CANADIAN BILLINGS & SPENCER PLANT - Welland, Canada



FRANKLIN
DIE-CASTINGS

The Safest Way To Save

A machined part may be perfect mechanically for your purpose—but too expensive.

Franklin Die-Castings have, in many instances, taken the place of machined parts—and not only served as well mechanically, but have the advantage of being absolutely uniform, and also much more easily adapted to quantity production.

Twenty-seven years' experience in the matter of supplying Franklin Die-Castings gives our engineers exceptional judgment in their application.

Booklet "C" will tell you interesting data. It is furnished on request.

Send a sample, or blue print of machined parts and we will furnish special report. Or, better still, let us send an engineer to consult with you.

Franklin Mfg. Company
746 Gifford St., SYRACUSE, N.Y., U.S.A.

VULCAN

NON-SHRINKABLE OIL HARDENING

DIE STEEL

was used to make these Government Gauges

Gauge No. 1		Gauge No. 2
2.506	Outside Diameter	2.016
2.433	Pitch Diameter	1.951
8	Threads per inch R. H.	12
1 in.	Length of Gauge	1⅛

TOLERANCES

Pitch Diameter—Plus or minus .0002
Lead—Plus or minus .00025 per inch of length
Angle—Plus or minus 5 minutes

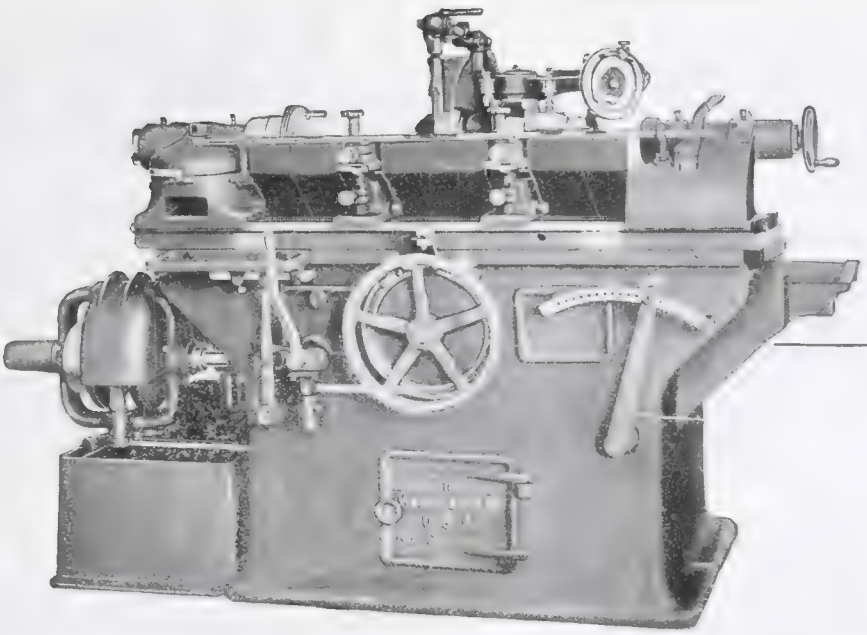
Allowance on pitch diameter for grinding .003 to .005, depending on diameter of gauge.

Change in Hardening { Lead not over plus or minus .001 per inch of length. Diameter not over plus or minus .001 per inch of diameter.

Name of manufacturer of gauges furnished on request.

Vulcan Crucible Steel Co.
ALIQUIPPA
Established 1900
PA., U. S. A.
Makers of Wolfram High Speed Steel
BRANCHES:
Boston . . . . 102 Purchase Street
Chicago . . . . 16-18 So. Clinton Street
Detroit . . . . 310 New Telegraph Bldg.
Montreal . . . . Herald Bldg.
Newark, N. J. . . . 52 No. 11th Street
St. Louis . . . . 1245 International Life Bldg.
WOLFRAM
MADE IN THE U.S.A.
HIGH SPEED STEEL
TRADE MARK

LANDIS



"You Can Do It On The LANDIS Universal"

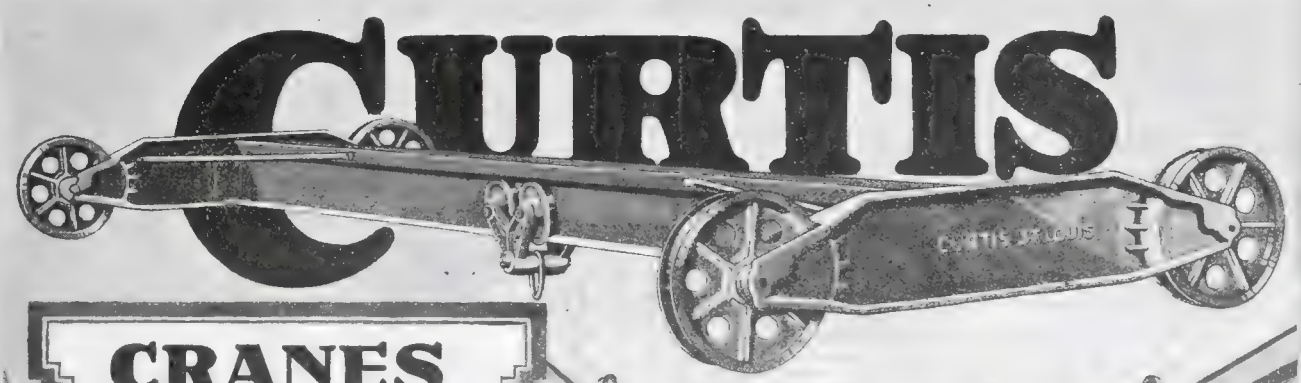
That's the answer to every query as to big production and the grinding possibilities on accurate or unusual work in hundreds of America's foremost shops.
The Landis Universal is particularly adaptable for every type of gauge making.

The widest range of work is handled by this machine with ease because of the simplicity of design of its various features.

Write for further details.

LANDIS TOOL COMPANY, Waynesboro, Pennsylvania, U. S. A.
New York City: 50 Church Street

CURTIS



CRANES

Have an enviable reputation for safety and ease of operation. Preferred in many leading industrial plants for their simplicity of design, being quick and easy to erect and therefore very low in cost of installation. Strong, rigid, dependable. Right in every detail. "They move the load with minimum energy." Hyatt Roller Bearings throughout.

Various types, hand and pneumatic, up to 20,000 lbs. capacity. *Write for illustrated descriptive literature.*

Curtis Pneumatic Machinery Co.
1585 Kienlen Ave., St. Louis, U. S. A.
Branch Office:
532-A Hudson Terminal, New York City

Sectional view of Curtis Crane Wheel showing Hyatt Flexible Roller Bearings.

Williams' "Vulcan" Drop-Forged Safety Lathe Dogs

DESIGNED to insure the maximum of safety, care was taken to provide a form as close to a circle as possible —no bunching or extension of the head portion, no "sleeve-catchers" to cause injury to the unwary operator.

They provide safety complete and automatic and, with this assured safety, better balance on the lathe and every whit of utility obtainable in this class of tool.

The price is the same as for the dangerous kind.

Bent and Straight Tail, 1 or 2 Screws, 16 Sixes, 3/8 to 6-inch Capacities.

Ask for Machinists' Tools Booklet

J. H. Williams & Co.

"The Drop-Forging People"

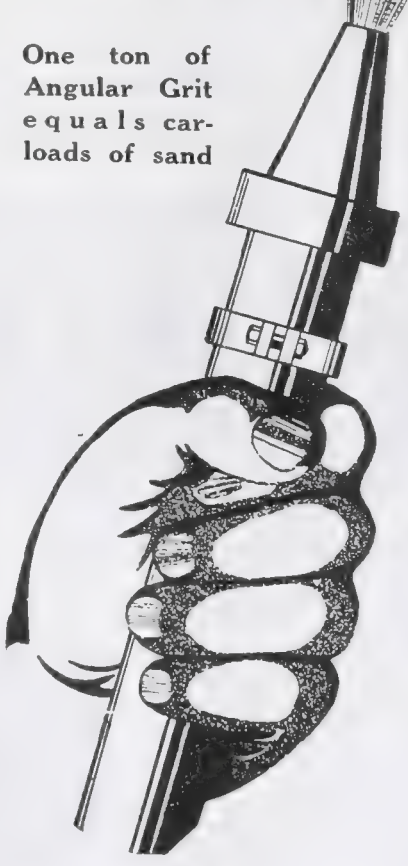
45 Richards St. Brooklyn, New York

THE A. G. LOW CO., LIMITED
45 Pacific Ave., Saskatoon, Sask.
Agents for Manitoba, Saskatchewan, Alberta and British Columbia

ANGULAR GRIT

Saves Labor
Saves Time
Saves Costs

Quicker and Better



One ton of Angular Grit equals carloads of sand

ANGULAR GRIT offers you the most advanced and economical method of cleaning castings, etc. Its angular and irregular cutting points clean raw castings and forgings more thoroughly and with greater speed than either sand or shot.

ANGULAR GRIT dispenses with sand bins and sand dryers, and there is no dust nuisance where it is used.

If you are using sand, think of the labor you can save by adopting ANGULAR GRIT in its place.

Used for all kinds of cleaning operations. Prove its superiority by giving it a trial.

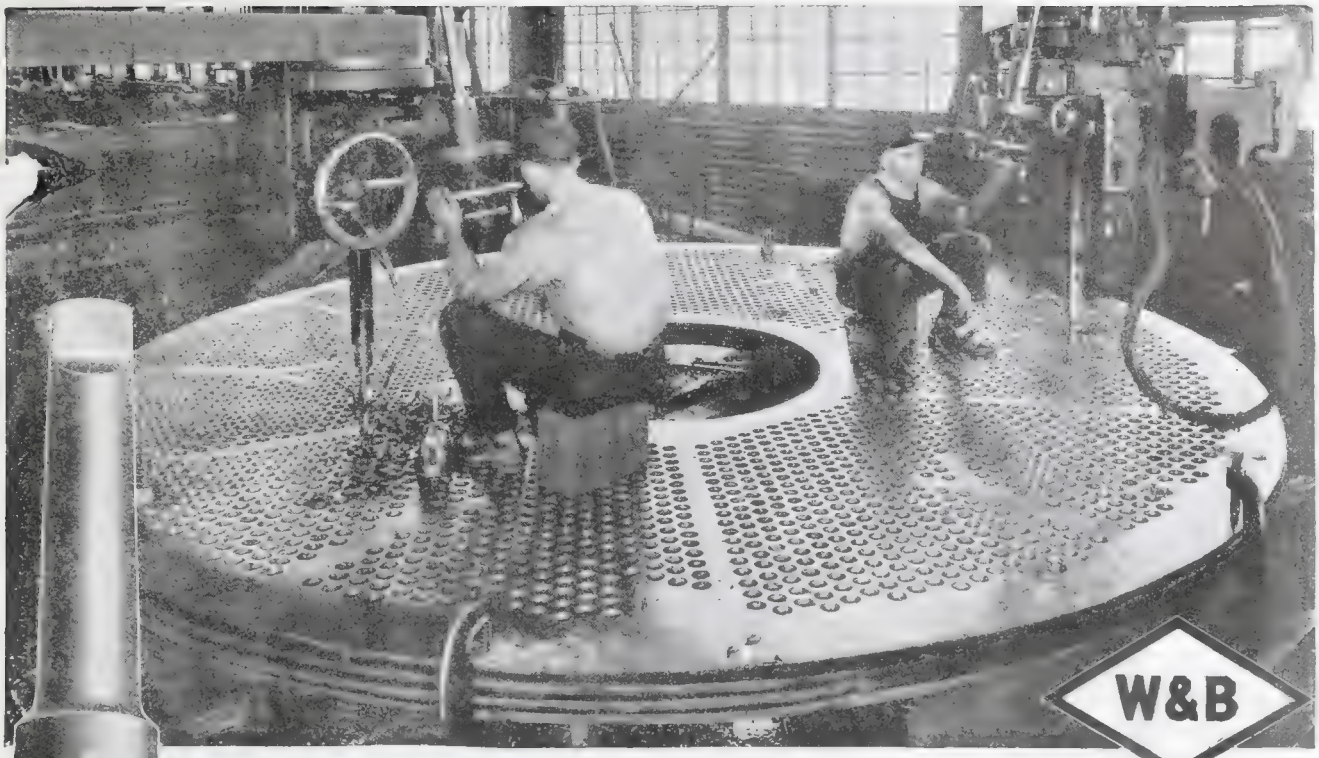
Pittsburgh Crushed Steel Co.

Established 1888

Pittsburgh, Pa., U.S.A.

Canadian Representatives:

Williams and Wilson Ltd., Montreal, P.Q.



The 12,408 holes in these Four Sugar Evaporator plates were drilled 1-47 64" with "W. & B" "Hercules" High Speed Drills and reamed to 1-49 64" with "W & B" High Speed Rose Shell Reamers.

Trade Mark Registered

12,408 Holes—Quick!

THE best drill presses and the most skilled mechanics on earth cannot drill accurate holes without good Twist Drills. Every Drill job requires speed, whether it is a rush order or not. Speed makes profits, conserves machine tool investment, cuts overhead, raises production and increases employees' income. Speed depends on Drill quality.

"W & B" Twist Drills as Speed Factors

Most makers of high grade machine tools invariably use "W & B" Twist Drills to demonstrate hole cutting capacity.

A "W & B" Twist Drill will test the machine where many other drills would break.

"W & B" Twist Drills retain their temper and cutting edge. They do not overheat. Less time is consumed in sharpening and grinding.

Manufacturers in all lines can reach a new production limit by using "W & B" Twist Drills and Reamers in their regular equipment.

"W & B" Twist Drills as Profit Factors

Your investment in machine tool equipment yields the greatest profits when "W & B" Twist Drills and Reamers are used.

"W & B" Twist Drills and Reamers stay on the work more hours, cut more accurately in more kinds of metals, produce more holes, more profits.

"W & B" Carbon and High Speed Twist Drills and Reamers are right for **every industry.** The "W & B" Diamond trademark has international recognition as a mark of achievement, capacity, extreme accuracy, ability to deliver and reasonable cost.

The Whitman & Barnes Manufacturing Co.

Office and Factory: St. Catharines, Ont. London: 139 Queen Victoria St., London, E. C.

Established 65 Years

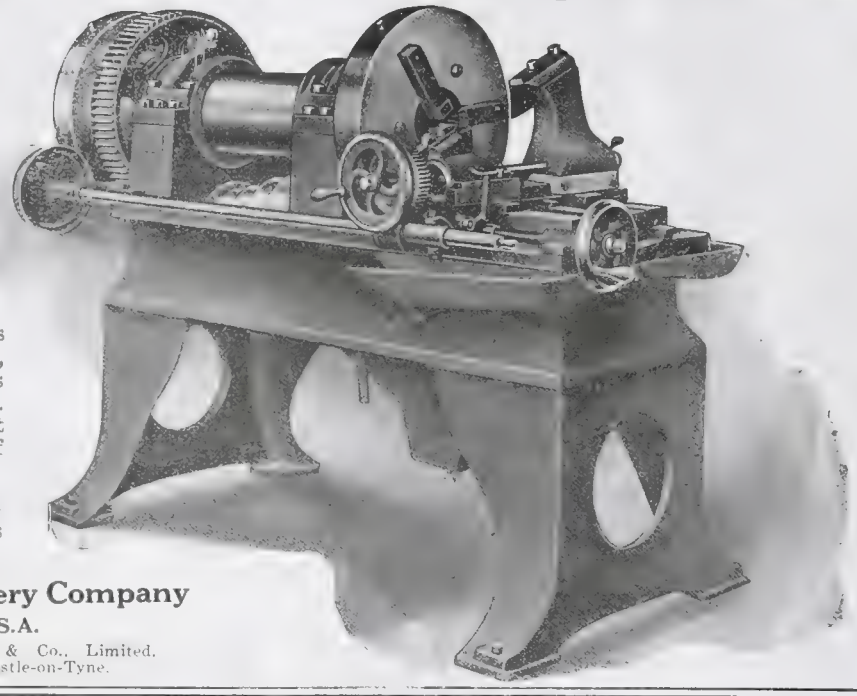
Whitman & Barnes

TWIST DRILLS — REAMERS — WRENCHES — HAMMERS

Cut Your Cutting-off Costs in HALF

HURLBUT'S

Patent Cutting-off and Centering Machines



TO say that the Hurlbut, Rogers Cutting-Off and Centering Machine will **double your production** and **cut your costs in half** may seem like a broad claim. But this is just what this machine will do compared with any ordinary machine of its kind.

Hurlbut, Rogers speed and efficiency is easily explained. Instead of only one, it is equipped with two cutting-off tools —one cutting up and the other down. In this way they hold the work against each other and finish a job in just half the time and do twice the work.

You can't afford to be without this machine. It saves real money. Let us tell you more about it. Write!

The Hurlbut, Rogers Machinery Company
South Sudbury, Mass., U.S.A.
Foreign Agents England: Chas. Churchill & Co., Limited. London, Manchester, Glasgow and Newcastle-on-Tyne.

IMPERIAL GENUINE BABBITT METAL

The Highest Grade Manufactured

Made specially for all HIGH SPEED, HEAVY ENGINES and EXTRAORDINARY HARD WORK

Manufactured and guaranteed to give excellent service by
THE CANADA METAL COMPANY, Limited, FRASER AVENUE TORONTO, Hamilton, Montreal Winnipeg, Vancouver

THE

TRADE K—T A IE MARK

FOUNDRY
GALT - ONT.

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. **We can advise you** and we have expert metal and wood pattern-makers who are able to make any changes that may commend themselves to you.

If you need some new Patterns

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

ASK US

GEAR GRINDING

The Heald No. 70 Internal is rapidly becoming known as "the gear grinder." Its unit heads which are easily interchangeable, together with the standard "draw in" collet holds the gears securely and can be readily equipped with special jaws, making it an ideal machine for grinding a hole in all sizes of spur, bevel and worm gears.

At the plant of the Albaugh-Dover Company, Chicago, Illinois, are three Heald Internal Grinding Machines finishing the holes in various types of gears of hardened steel.

They are using the standard draw-in collet regularly furnished with the machine as a fixture with the following results:

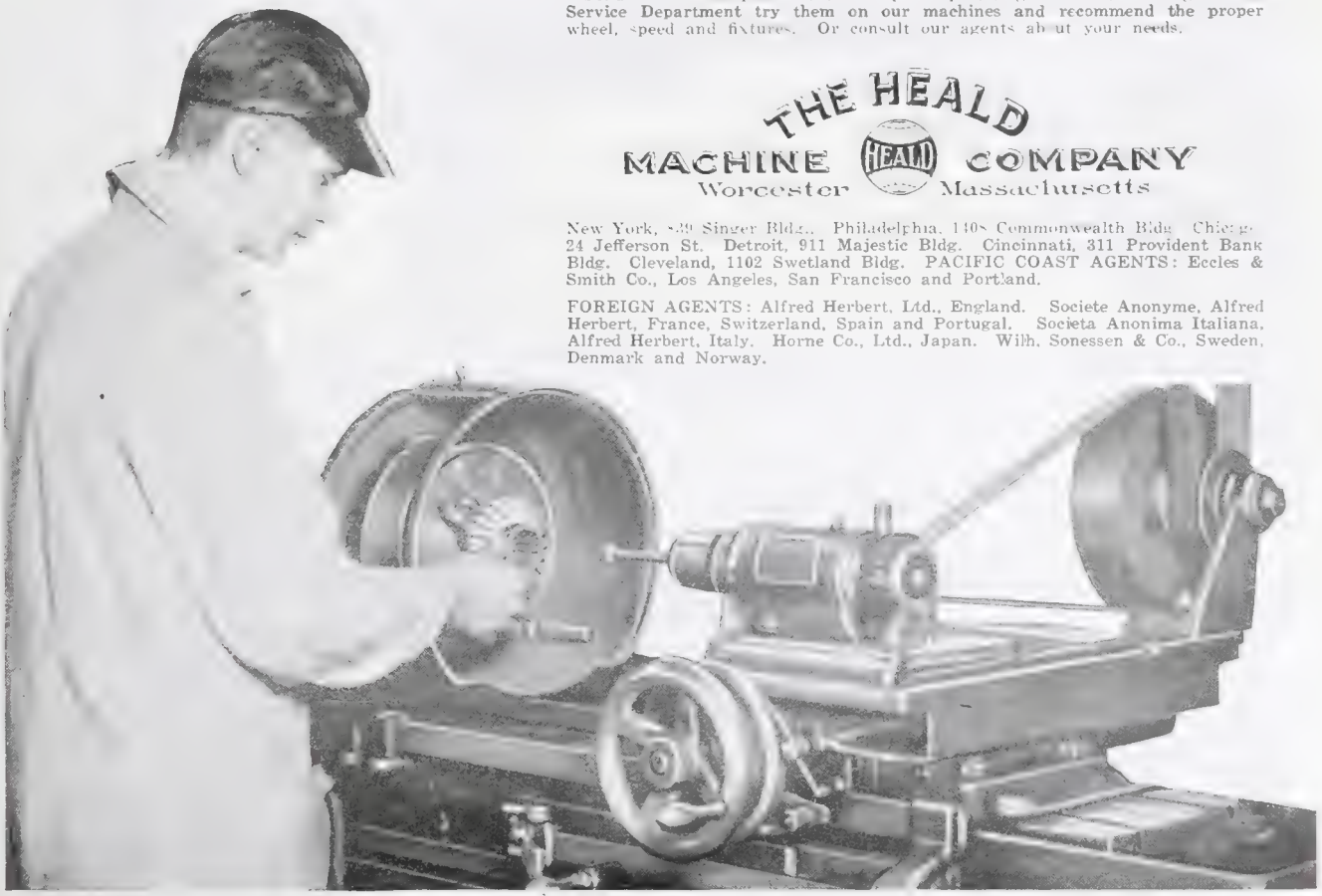
No. of Part	Dia.	Length	Limit	Removed	No. per hr.
Differential gear	1⅝"	2½"	.001	.011	13
Miter gear	⅞"	2¼"	.001	.010	20
Bevel gear	1⅜"	3"	.001	.015	12

Send us some samples of the work you expect to grind. Let our Engineering Service Department try them on our machines and recommend the proper wheel, speed and fixtures. Or consult our agents about your needs.

THE HEALD MACHINE COMPANY
Worcester Massachusetts

New York, 239 Singer Bldg., Philadelphia, 1108 Commonwealth Bldg. Chicago 24 Jefferson St. Detroit, 911 Majestic Bldg. Cincinnati, 311 Provident Bank Bldg. Cleveland, 1102 Swetland Bldg. PACIFIC COAST AGENTS: Eccles & Smith Co., Los Angeles, San Francisco and Portland.

FOREIGN AGENTS: Alfred Herbert, Ltd., England. Societe Anonyme, Alfred Herbert, France, Switzerland, Spain and Portugal. Societa Anonima Italiana, Alfred Herbert, Italy. Horne Co., Ltd., Japan. Wilh. Sonessen & Co., Sweden, Denmark and Norway.



WAR is destructive. Peace is constructive, War has taught us many things, chief of which is the great value of Time. Time is the essence of your life and mine. Whatever saves Time, saves Life.

"RedCut Superior"

The Nationally Known FIRST QUALITY

HIGH SPEED STEEL

Is the Avowed Enemy of Waste and Inefficiency, and is Allied with Life

Save Time, Save Life. Are your Tools made of RedCut?

VANADIUM-ALLOYS STEEL CO.

General Sales Offices, PITTSBURGH, PA.
Works, LATROBE, PA.

This Time It's Register Frames

The Egry Register Co. of Dayton, Ohio, has been using this particular NATCO Multi-Driller for four and a half years—"no trouble and no repairs."

At the left is one of their register frames—cast iron 3/8 inches thick. The NATCO drills 16 holes—ranging from No. 48 to 5/16 in. diameter at the rate of 216 frames a day.

THE NATCO patented feature—Independent Change of Speed for Each Spindle—makes this possible, for the NATCO is the only machine that will drill, ream, tap, counterbore or spotface different sized holes in one operation with each tool driven at its approximately correct cutting speed.

Let us make you production estimates

The National Automatic Tool Co. Richmond, Ind.

FOREIGN AGENTS

Burton, Griffiths & Co., British Isles
Allied Machinery Co. of America, Italy
Spain, Portugal and Switzerland

Aux Forges De Vulcain, France
E. Isbecque & Co., Belgium

JUST ONE OF THE MANY PRECISION GRINDING JOBS ON WHICH

ALOXITE WHEELS

HAVE MADE POSSIBLE A GREATER ACCURACY; A GREATER PRODUCTION AND A GREATER SAVING IN TIME AND IN GRINDING COSTS

The work is grinding piston rods in an Eastern New York shop—the wheel holds its shape assuring a perfectly round rod, cuts free and fast without chattering, leaving a splendid commercial finish—and it shows a real economy in increasing production and in its long life.

Suppose you put some of your grinding work up to our service department.

THE CARBORUNDUM COMPANY

NIAGARA FALLS, N. Y.

NEW YORK CHICAGO BOSTON PHILADELPHIA CLEVELAND CINCINNATI PITTSBURGH MILWAUKEE GRAND RAPIDS

CUT YOUR CUTTING COST WITH VICTOR Flexibles

The high cost of tools should emphasize more than ever the importance of quality.

The high cost of hack saw blades ought to drive every hand blade user over to the saw that does not break in ordinary hand work.

VICTOR FLEXIBLE HACK SAW BLADES have exactly the same cutting power as the finest All-Hard on the market, and that they cannot be broken in use except by intentional abuse is an undisputable fact—which will represent a saving from twenty-five percent to thirty-three and one-third percent in breakage alone.

Seventy-five percent of the All-Hard blades used in hand frames break before they are worn out. Watch the All-Hard blades in your own shop and see the enormous amount of breakage—then use VICTOR FLEXIBLES and note the economy.

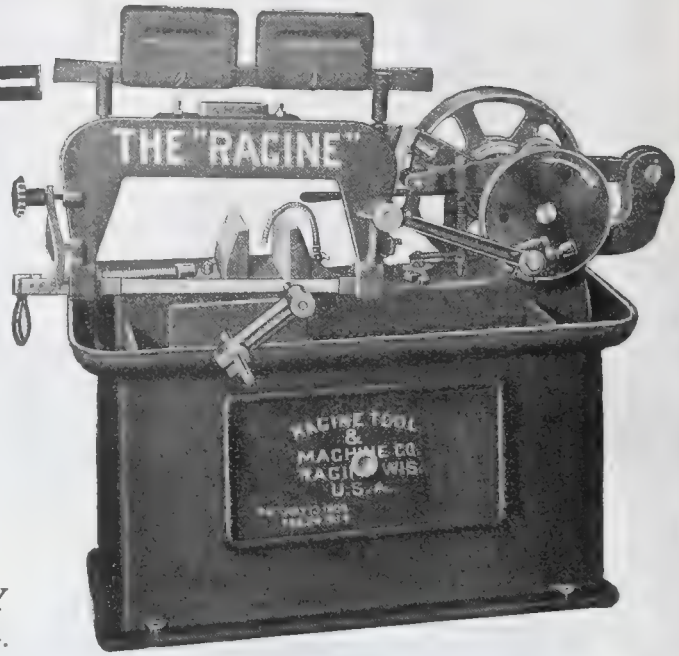
VICTOR SAW WORKS LTD - HAMILTON, CANADA

"THE RACINE"

High Speed Metal Cutting Machine

Standard the World Over

This is the only machine in the World that has an ABSOLUTELY POSITIVE AUTOMATIC LIFTING DEVICE, a feature secured by patents. Another feature is the rigid saw frame guide. These two assets combine to give long life to the cutting blades and save a lot of money.



"THE RACINE" minimizes wastage, cuts accurately and with great speed. Then they are easy and cheap to operate. These features are appreciated by the best shops everywhere and that's why "THE RACINE" sets the "Standard the World Over." Write for full particulars.

Use "RACINE" H.S. Tungsten-Power Blades.

RACINE TOOL & MACHINE COMPANY

Melbourne Ave. ∴ RACINE, WIS., U.S.A.

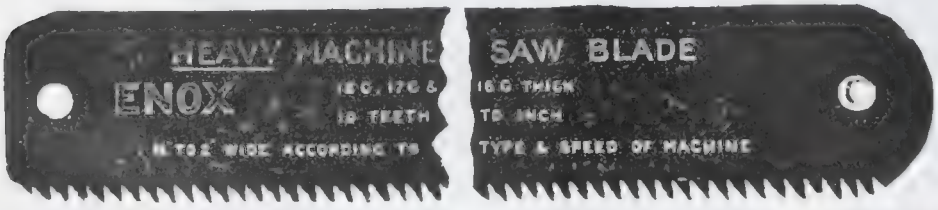
SIMONDS

HACK SAW BLADES

UNEQUALED IN QUALITY ANY SIZE OR LENGTH

Simonds Canada Saw Co. Limited

ST. JOHN MONTREAL VANCOUVER



ENOX

Hacksaw Blades

ARE THE BEST

AGENTS IN CANADIAN TOWNS WANTED

Liberal Terms offered to firms willing to carry stocks and act as sole agents for the district.

Makers:

FRY'S (LONDON) LIMITED

AN ENTIRELY BRITISH COMPANY

46 Upper Thames St., London, E.C. 4, England. Works: Greenwich, S.E. 10

Agents for Canada, East of Fort William

THE STANDARD MACHINERY & SUPPLIES, LIMITED, 261 Notre Dame St. West, MONTREAL, QUE.

Agents for British Columbia—The A. R. Williams Machinery Co., Limited, 495 Railway St., Vancouver, B.C.

Starrett Hack Saw Charts
Belong In Every Tool Room

THAT MAN ISN'T GUESSING

He knows he is giving out the right blade for the job because he looked in the Starrett Hack Saw Chart when the machinist told him what he wanted to cut.

For any but the most unusual conditions, a Starrett Hack Saw Chart in the tool-room is almost as good as having a service man in the factory—and it's always there when you want it.

A copy of the Chart or the Starrett Catalog No. 213 sent free upon request.

The L. S. Starrett Co., Athol, Mass.

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

42-917

STARRETT HACK SAWS

STERLING
HACK SAW BLADES

A proof of the fact that quality is always cheapest in the end. If you want durable hack saws, fast-cutting, keen and tough, then be sure your order calls for "STERLING" Hack Saw Blades. It's a guarantee of satisfaction.

Manufactured by

Diamond Saw & Stamping Works
BUFFALO, N.Y., U.S.A.

Hat Saws, Friction Discs, Solid Blades made of Vanadium, Tungsten and Chrome Alloy Steels. Saw Sharpening Machines. Inserted Tooth Grinders. Hardened Steel Specialties.

HUNTER
Duplex Saws

The selection of many of the best and largest companies in the country for cutting ingots, bars, forgings, castings, rails and structural shapes.

Their fast cutting qualities mean a saving of time and power, plus increased production.

Teeth are accurately formed, ground and set for highest speed and greatest endurance. Made in sizes up to 90 in. in diameter.

Write for price list and full particulars

HUNTER SAW & MACHINE CO.
Pittsburgh, Pa.

BROWN'S

Beaver Brand Metals

Copper, Brass, Bronze, Canada Silver, and Gilding Metal in sheets, rolls, plates and rods. Naval Bronze, Yellow Metal and Muntz Metal in sheets and rods for shipbuilding requirements. Specify Beaver Brass Rod for drilling and free cutting. Extruded shapes.

Guaranteed Ingot Metals—Yellow, Red and Composition Ingots.
We are Purchasers of Copper Bearing Material.

Link up with Beaver Brand Products—you'll like the quality, price and service.

Brown's Copper & Brass Rolling Mills, Limited

New Toronto, Ont., Can.

COPPER & BRASS
BROWN'S
QUALITY
ROLLING MILLS

MALLEABLE AND CAST IRON PIPE FITTINGS

M

The Brand That Has The Quality

"Quality" and "Reliability" are two essentials demanded of *Cast Iron* and *Malleable Fittings*, by all sanitary and heating engineers.

Time and money are lost by improperly made fittings. All our cast iron and malleable fittings are properly recessed and every fitting bears the above trade-mark of quality.

We make a complete and full line of both flanged and threaded fittings from ⅛-inch up, and can make deliveries from stock, both standard and extra heavy.

When ordering from your jobber be sure you buy—"the brand that has the quality." They are different. A trial order will convince.

International

Malleable Iron Company, Limited

Guelph, Ontario, Canada

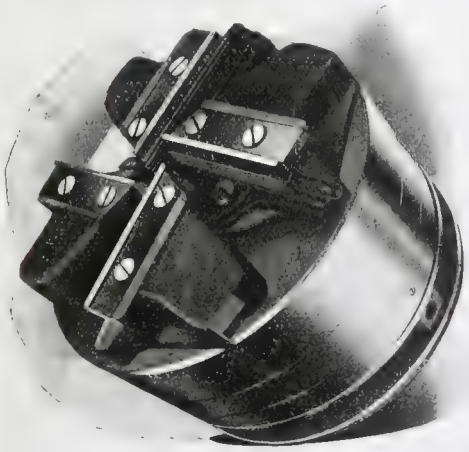
How Many Threads in a Dollar?

That is the all-engrossing question of the manufacturer to-day, whether cutting threads on a production basis or as a maintenance proposition.

Landis Threading Die Heads and Machines insure profitable threading because:—

The chaser like a lathe tool is tangentially disposed to the work, eliminating all unnecessary friction.

The chasers are interchangeable in that any one or more may be replaced without renewing the entire die.



The chaser has a variable cutting angle which may be ground to suit the material being threaded.

The chasers never require recutting but when dull are given a slight grinding.

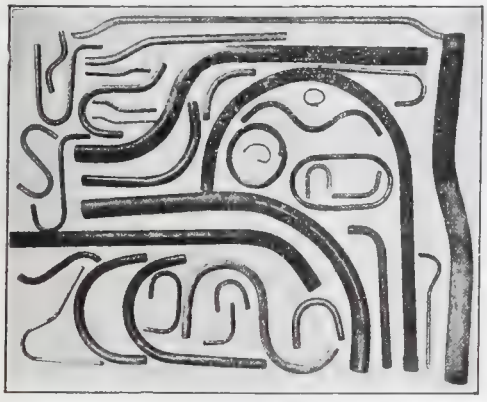
The chaser is 4 inches long, giving a life twenty times that of other dies.

Your money invested in the Landis Die will yield big returns in best quality threads.

Catalogue 24 tells the whole story.

LANDIS MACHINE COMPANY

WAYNESBORO, PA.



POWER -- BENDERS

THREE NEW MODELS

"Wonder" Pipe Bending Machines (pat.)

Electrically operated to bend from ⅛″ to 20″. Send for printed matter. We also manufacture TEN other sizes, hand operated benders.

American Pipe Bending Machine Company

52 Pearl Street **Boston, Mass., U.S.A.**

HOYT METALS

"Frost King"
"Trojan"
"Nickle Genuine"
BABBITTS

Hoyt Metals have been used with great success for many years.
Put them to the test and you'll soon see a difference in your babbitt cost.
All elements entering into our mixtures are carefully refined and put together in such proportions and in such relation to each other that the best possible alloy is secured for the work for which it is designed.

Annual sales over $5,000,000.

Hoyt Metal Co., Toronto

New York, N.Y. London, Eng. St. Louis, Mo.

FIRE ANNOUNCEMENT

We are pleased to say that the fire which occurred in our plant on Saturday, June 21st, will not have very serious results.

Machine shop and foundry were uninjured and patterns are being rapidly replaced.

Drawings, part lists and all records enable us to go right along with the minimum of delay.

Parts of machines in stock are uninjured as no fire was anywhere near them.

We can offer Lathes, Shapers, Drills and Pipe Machines for immediate delivery.

THE R. McDOUGALL CO., LIMITED
GALT, ONTARIO, CANADA
CANADIAN FAIRBANKS MORSE CO., LIMITED, SALES AGENTS

Swedish Steel & Importing Co., Limited
Montreal Toronto
New York Denver

Direct representatives of foremost Swedish mills: makers of

Tool Steels

ALLOY STEELS, BILLETS, BARS, DISCS, SHEETS, HIGH SPEED STEELS, DRILL RODS, DRAWN BARS, SEAMLESS TUBING, COLD ROLLED STRIP STEEL, WELDING WIRE, WROUGHT AND ROLLED IRON, PIG IRON, STEEL AND IRON ENDS, HOLLOW AND SOLID MINING DRILL STEEL.

TRADE MARK SS

PROMPT SHIPMENTS from large stock

MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

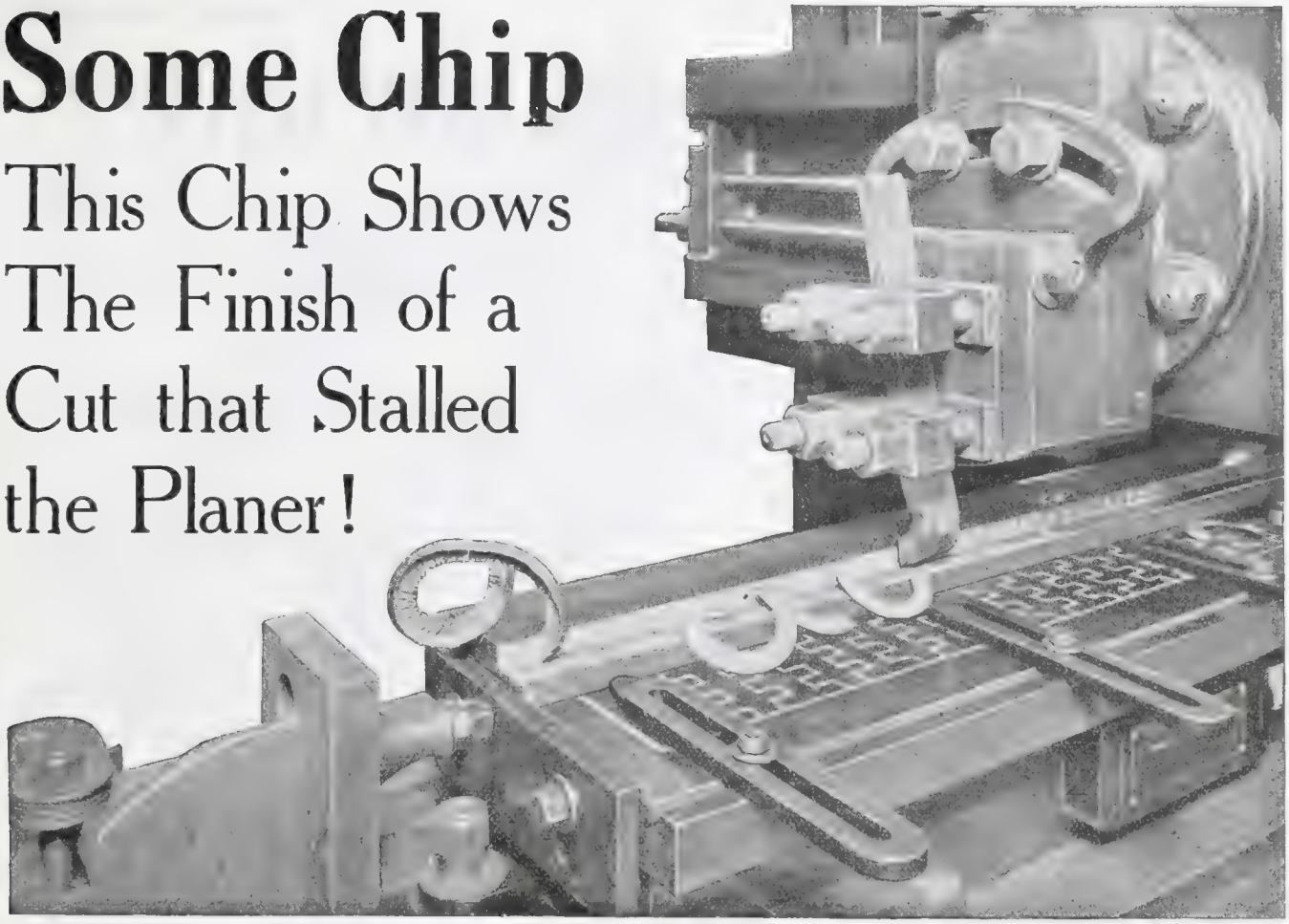
Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.
Structural Steel and Steel Plate Work, and a combination of the two lines.

Prompt Deliveries Assured.

MacKINNON STEEL CO., LIMITED
Sherbrooke, Quebec
Montreal Office: 404 New Birks Building

Some Chip

This Chip Shows The Finish of a Cut that Stalled the Planer!



The cut was started at the far end of the piece and the work never budged.

Some of the factors that contribute to the holding power and reliability of the SIMMONS UNIT-POLE MAGNETIC CHUCK are

1—Effective utilization of the space on the face of the chuck;
2—Use of unit magnetic pole pieces of forged iron placed adjacent to each other with no neutral poles or neutral spaces between them;
3—Gaps between poles uniform throughout because adjacent edges are machined to definite dimensions;
4—Complete magnetic circuit insulated from the body of the chuck—a patented construction.
5—Machine wound coils assure uniform quality and equal ampere turns in all;
6—Interlocking pole pieces offer transverse as well as longitudinal resistance to the work;
7—Watertight construction.

DETAILS OF TEST

The test here shown was made on a 30-inch Gray planer equipped with a 31 x 10¼ inch T-slot Simmons Unit-Pole Magnetic Chuck. The cut was taken on a cold rolled steel bar 31 inches long, 4 inches wide and ¾ inch thick. The chip was ⅝ inch deep and 3-16 inch thick. It stalled the machine.

The Simmons unit-pole magnetic chuck works where others fail, because it is designed in accordance with the principles of correct magnetic practice and gets the maximum pulling power that can be obtained in a given space. Catalog 105E will be mailed on request.

TAFT-PEIRCE

Woonsocket, R.I., U.S.A.

g

Detroit Office: Majestic Building

Williams & Wilson, Limited, Montreal and Quebec

THERE IS "A REASON WHY"

When Germany signed the Armistice, Walcott Lathe Company accepted cancellations of orders for Lathes amounting to hundreds of thousands of dollars. Not one cent of damage from the United States Government or anyone else was claimed on account of the cancellation.

YOU SAY, WHY

Because Walcott Lathes are standard equipment throughout. They are built and designed for manufacturing purposes in sizes to meet every requirement of your shop. Thus, we have had a constant increasing demand for Walcott Lathes for the past thirty-eight years, not from one section of the country, but from all over the world. Our business is good, and our plant is running full time, not a man idle.

If you are interested in new Lathes, specify the WALCOTT, and you will find by their many advantages "The Reason Why."

WALCOTT LATHE COMPANY

Engine Lathes

140 Calhoun Street - JACKSON, MICHIGAN

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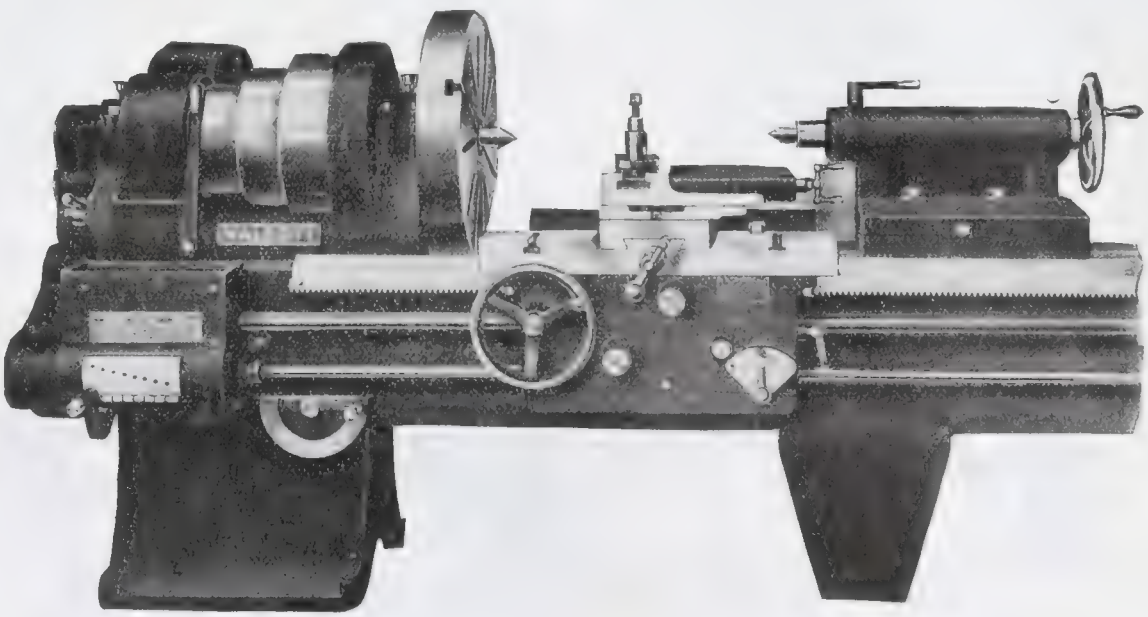

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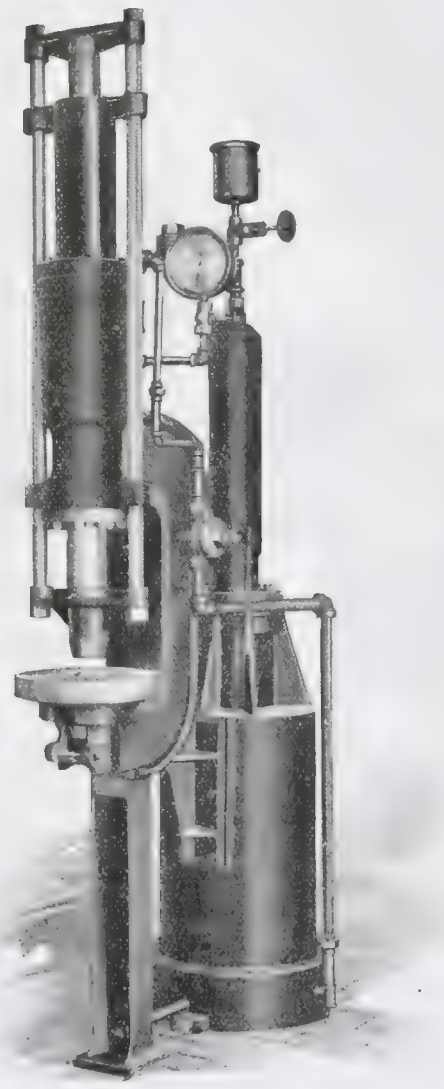

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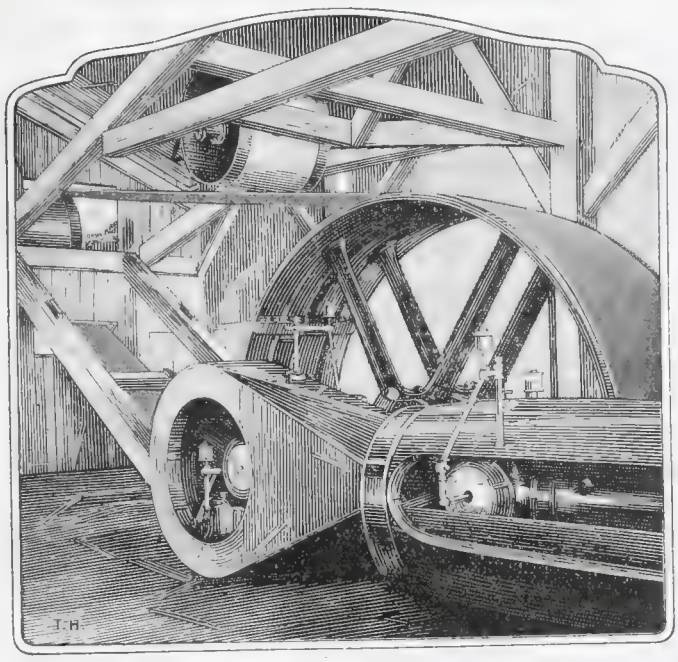
Through the scientific investigation of our Engineering Department, all the factors which enter into the design of a belt have been standardized. According to best modern practice, belts are designed with an overload capacity of about 60%. Such ratings are found to give the lowest cost per horse-power transmitted per year.



48" Heart 3-ply Belt, 86 feet long, installed in 1911 in the mill of the C. A. Smith Lumber Company, Baypoint, Cal. Driving Pulley, 14 feet, 101 R.P.M. Driven Pulley, 4 feet. Belt Speed, 4400 F. P. M. Theoretical horse-power, 600. Actual horse-power transmitted, 850 to 900. Cost of Belt, 1-5 of 1c per horse-power per week.

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Think what this belt must do. Travelling at 4,400 feet per minute, it makes its circuit fifty times every sixty seconds. For every one of these revolutions, each part of the belt must slacken and tighten itself, practically once a second.

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Note On Grinding
NORTON COMPANY WORCESTER MASS.

No. 59A

Judging the Grinding Action

Because of so many unavoidable variations in the size and structure of the casting or billet it is a difficult task to determine the relative merits of snagging wheels. But the only reliable factors for judging of the suitability of an abrasive structure are the rate of cutting and the amount of abrasive material worn away per unit of volume of metal ground. Any other basis of selection is an approximation for these two quantities, and experience has shown that even the opinion of expert grinding operators is subject to many uncertainties unless supported by actual data on the rate of cutting and grinding capacity.

IMPORTANCE OF OPERATING CONDITIONS

In fact if these data were daily collected for a long period of time, it would be seen that the action of a snagging wheel is very sensitive to any variation of the following conditions:

1. The manner in which the grinding wheel is applied.
2. The speed of rotation.
3. The daily changes in structure of the metal, "chill" and amount of metal to be removed.
4. The method of grinding employed by the operator, whether the work is done with the edge of the wheel or the face, and the amount of traverse of the work with respect to the wheel.
5. The rigidity with which the work is held while being ground.
6. The condition of the grinding machine with especial reference to the bearings, tension, and width of belts, and amount of power available.

Each of these factors may have more effect upon the grinding action than a change of grit or grade of the abrasive structure. That is why no one can reliably foretell the grit and grade of snagging wheel best suited for a particular set of operating conditions. Foundries of the same concern and making the same product will select grinding wheels of different structure.

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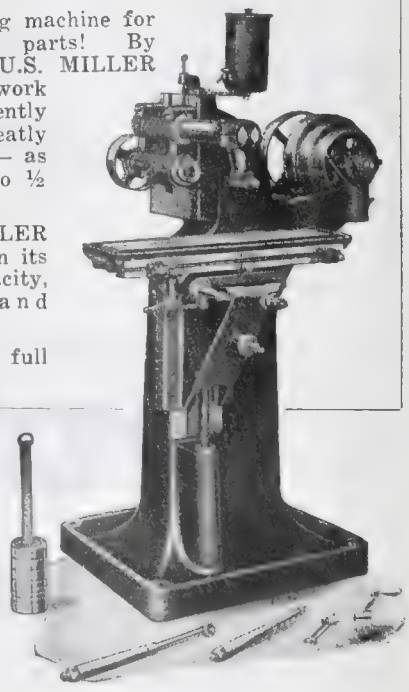

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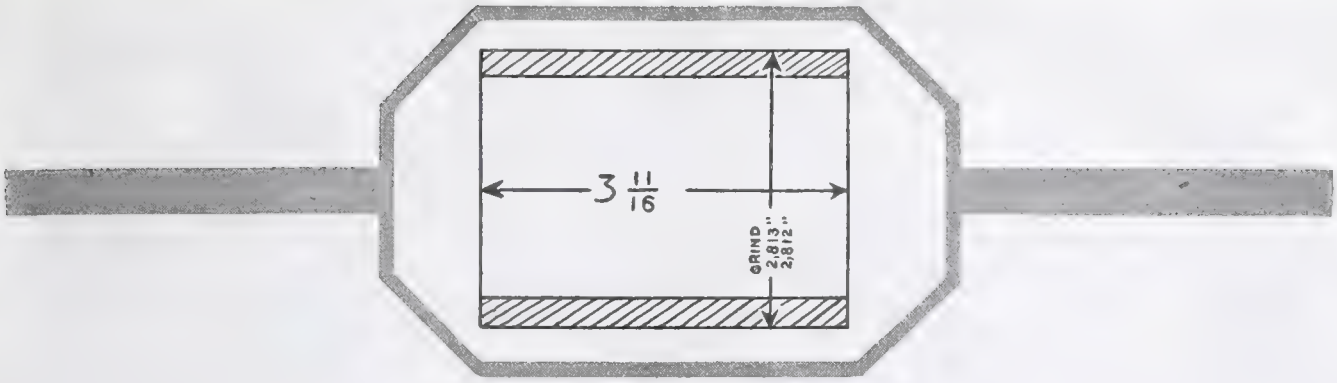

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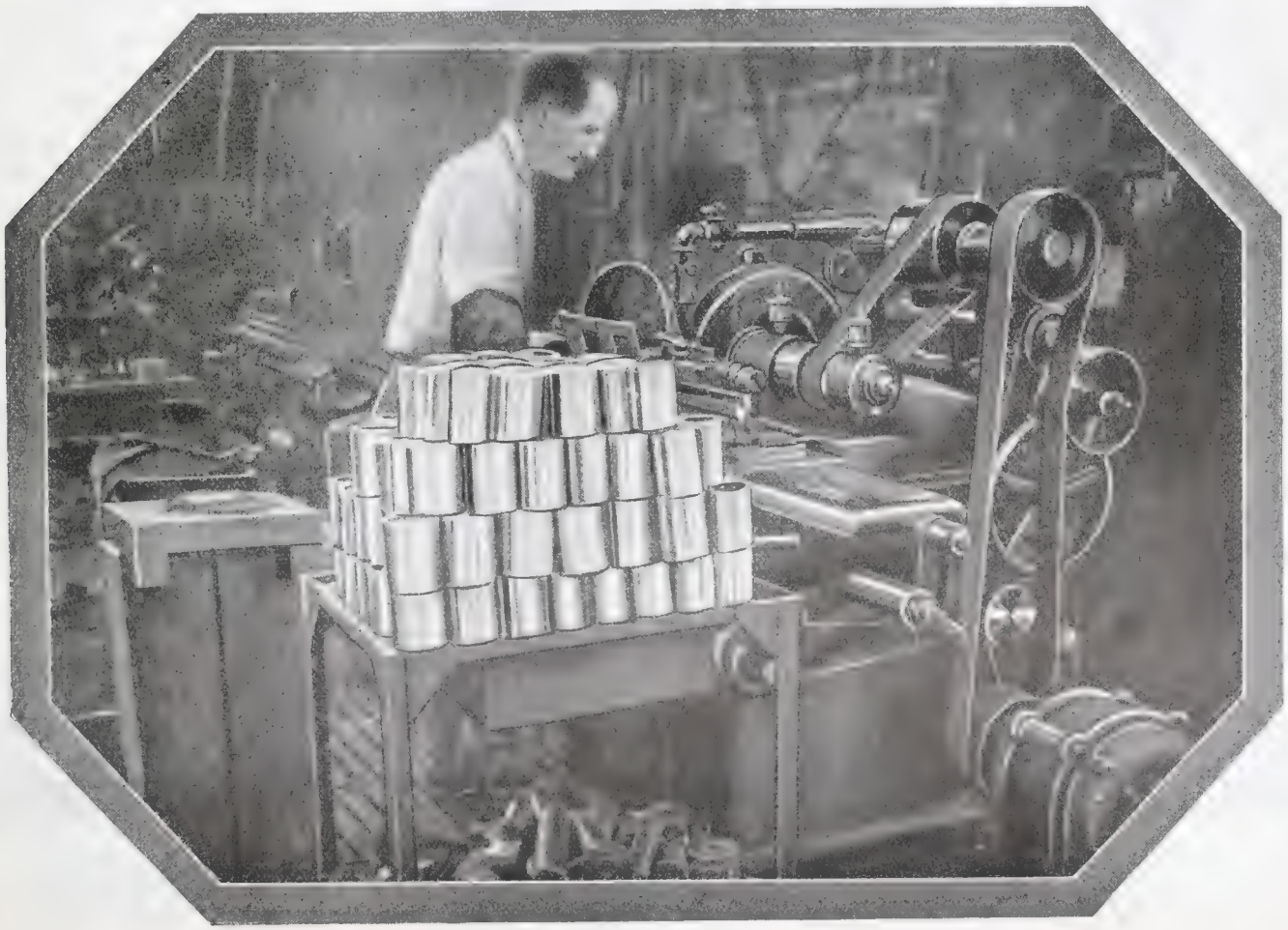

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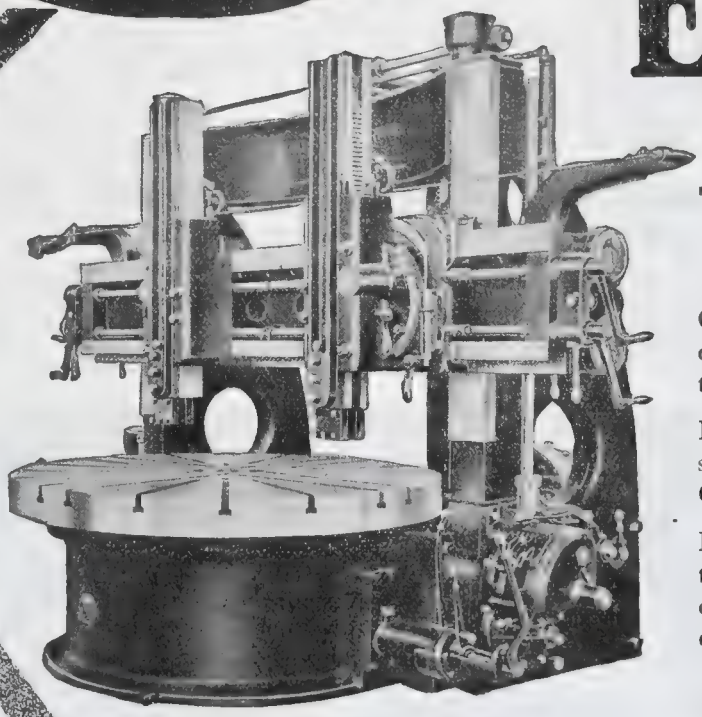

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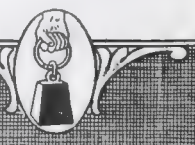

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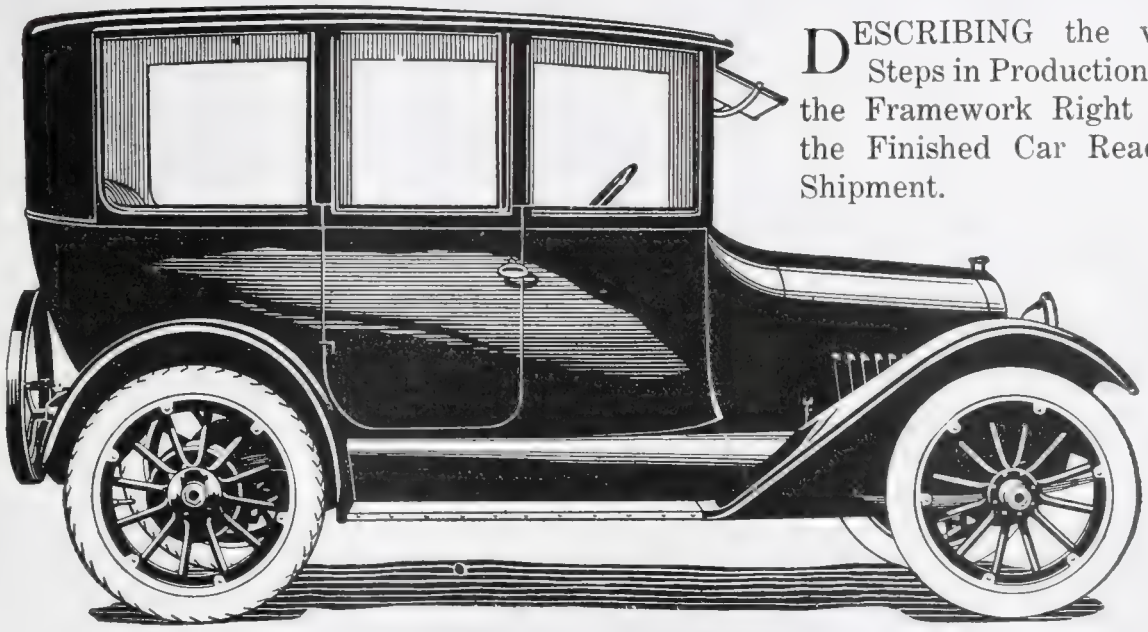
CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XXII. No. 1. Toronto, July 3, 1919

Manufacturing the Chevrolet Motor Car



DESCRIBING the various Steps in Production, From the Framework Right Up to the Finished Car Ready for Shipment.

By J. H. MOORE, Associate Editor Canadian Machinery

IT is a well-known fact that in some cases where an article on some particular machine or subject is to be prepared, the first customary step is to describe the product itself before going on to its manufacture. In this case in point, however, such a description would be superfluous, for where is the man or woman, yes, even the kid (as we generally term them), who cannot tell you what an automobile is. What's more, even the children can proudly say as a car whizzes past, "That's a ——," as the case may be.

But how does it come that even the kiddies can pick out a certain type of car from amongst so many different types? If the writer is allowed to answer his own question, here is at least his humble opinion. The child overhears its parents or some other party of older years discussing the various cars on the market, together with their records, price, etc., etc. A child's mind is very fertile, and, naturally, the information falls in good soil, so we later hear them exclaim as the car goes past, "There goes a ——."

Now, since we've reached this point, let us ask readers another question. How often have we heard a kid saying, "There goes a Chev." (which is their favorite pet name for the Chevrolet car).

Quite often, no doubt, which proves the writer's previous theory, that the kids soon learn to know of the car whose price, performance, and record, are well known. In other words, they soon get to know the name of the popular car, which in common parlance, means the Chevrolet, for this car has been discussed by no doubt half the population of Canada.

CANADIAN MACHINERY figured it out this way: People in general are interested in this automobile, so why not the mechanic? No doubt he will be even more interested. Arrangements were made to secure such an article with the result to follow. In as far as possible we will describe the various processes throughout, but naturally readers can understand that there must be certain operations which cannot be gone into in detail for obvious reasons.

As readers no doubt already know, the Chevrolet Motor Car Company of Canada, Ltd., have their plant located at Oshawa, Ont. These quarters are spacious, to say the least, and some idea of their exterior appearance can be gleaned from the photograph at Fig. 1, showing a general view as we approach the plant.

To the extreme right of this picture will be noticed a portion of the main office, while on the extreme left is shown the production and cost department office building. Further in the rear readers will notice a portion of the plant building, with the covered bridge going from one building to another.

Referring for a moment to the office staff. Here we find some 100 workers, busily engaged in carrying on the different departments of office routine, which gives readers a slight conception of the vast volume of business which passes

FIG. 1—GENERAL VIEW OF A PORTION OF THE PLANT AS IT APPEARS FROM THE STREET.

through their hands. But we will not dwell on the office problems, for this article is chiefly intended as a manufacturing study.

It will not be amiss at this point to first of all describe the various models of cars which this firm turns out. They have what is known as their Model 490, a serviceable car of lighter weight than their next, Model F.B., or, as it is better known, their Baby Grand Model. This latter car is a larger and heavier model than the former one spoken of.

To allow readers to compare these cars from a photographic standpoint, the writer has illustrated this article with photographs of both models spoken of. A study of the specifications, which follow later in this article, will further allow comparison between these two cars.

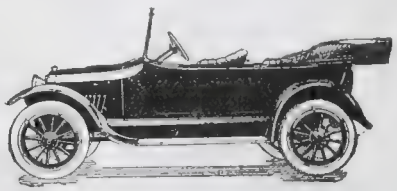
In addition to these models, they also manufacture a light delivery waggon, also a one-ton truck.

So now that we have mentioned these different types, let us go into the actual manufacture of the Model 490 and F. B. cars.

The various operations on these models are similar, so that for the purpose of this article one description will suffice for both cases, but underneath each photograph readers will find a description of the type portrayed.

The Frame

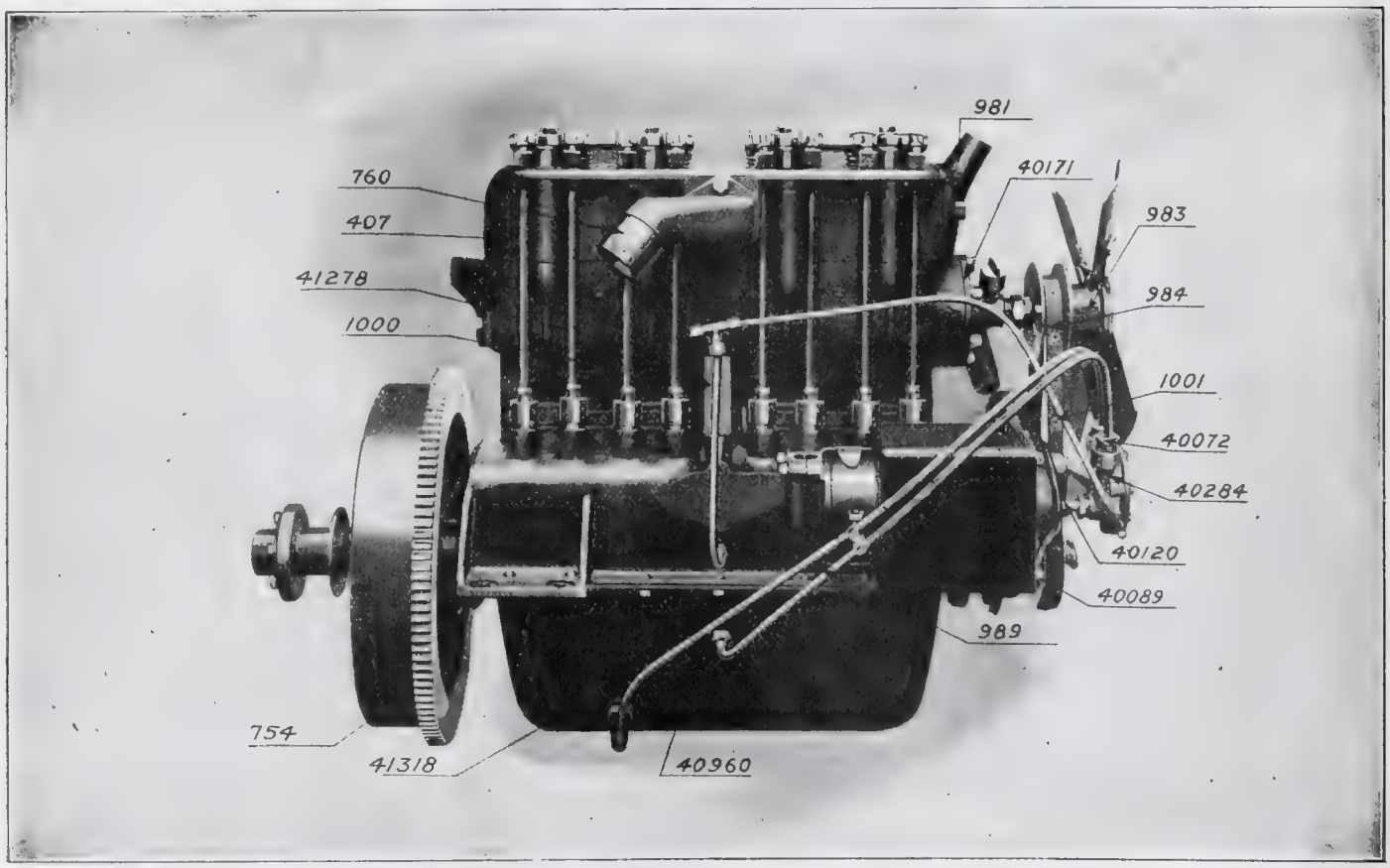
To commence with, let us consider the frame. This portion consists of some twenty parts, not to speak of the rivets used on the same. This frame is first of all drilled, and later assembled, the various pieces being riveted together. This latter operation is a very interesting one to watch. Air hammers are used for this purpose throughout, speed being the big factor. Air hoists are also employed to lower these frames to the trucks on which they from now on rest, until their completion. These trucks are of course specially constructed to accommodate the frame, being of correct length, shape, etc., so that it is but the matter of a moment to place the frames firmly on same.



GENERAL APPEARANCE OF CAR MODEL 490.

The springs and axles are now assembled to the frame, after which they are transferred to the department where the motor is assembled to the frame.

Before going on to this operation, however, let us see what has been happening while the frame has been passing



1918-1919 MOTOR WATER PUMP COOLING SYSTEM, MODEL 490 CAR.

FIG. 2 ASSEMBLING THE MODEL 490 ENGINE.

through its various stages of manufacture.

Directly across the floor from the frame riveting department, the "490" model motor is assembled. Fig. 2 illustrates clearly an assembler at work on one of these engines. The motor is assembled with great care, and is carefully inspected at a later stage of manufacture.

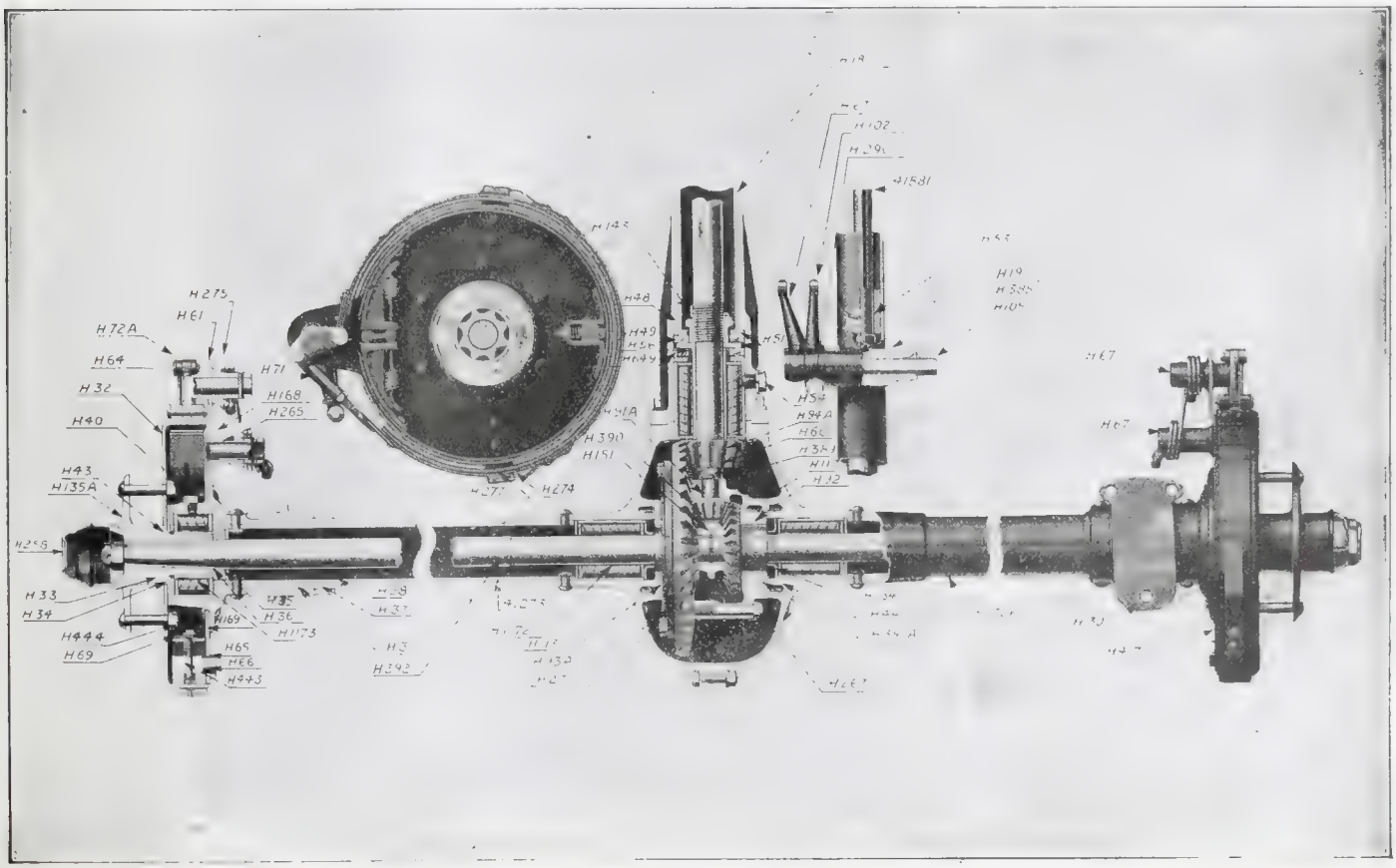
These motors now go to the same department as the frames, where the motor is assembled to the frame. They now pass on a little further (in fact merely a distance of the length of the truck).

Motion Study

It will be noticed that while speaking of these various steps, the words "pass on" are used quite a bit. In reality this is what actually happens, for each assembler right down the line has his particular portion to assemble, after which he gives the truck a push one length ahead to the next assembler, and so on. Each movement is carefully thought out in order to reduce lost motion to the minimum. In this way better work is accomplished, for each man becomes a specialist in his own particular operation, and his work is likewise more speedy the longer he stays at it.

Production soars by the adoption of this modern method of manufacture, in fact a car of such a standard as the one described could never be turned out for the money they now sell at were it not for this study of motion and operations.

The muffler, starting gear, underpan, drip pan, radiator, coil distribution tank, tire carrier, etc., are now assembled, after which the frame is inspected, and all necessary parts filled with oils and grease. The framework, or chassis, as it is often called, now looks like the view shown at Fig. 3.



DETAILED VIEW OF REAR AXLE ON THE MODEL 490 CAR.

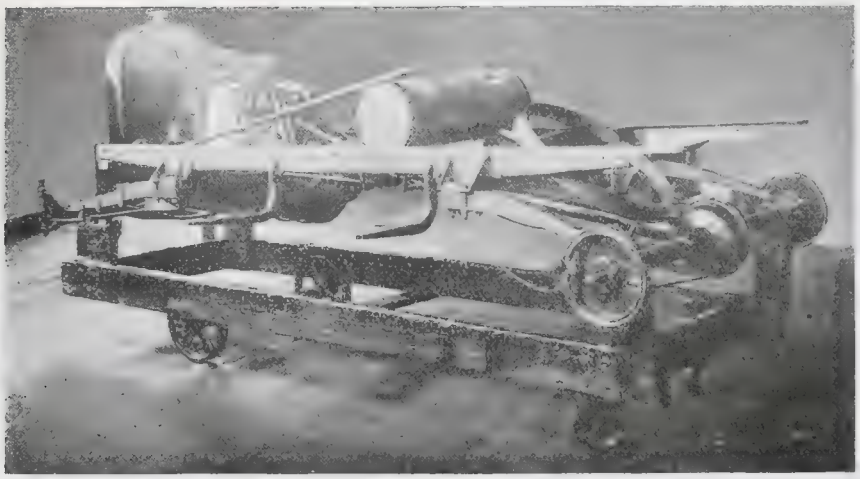


FIG. 3—MODEL 490 CHASSIS JUST BEFORE IT ENTERS THE AIR GUN PAINTING CHAMBER

Air Gun Painting

The chassis now goes into a special painting chamber, where it is painted by means of an Aeron air gun. This method produces a good, even, penetrating coat of paint, at the same time speeds up the work. When we mention that the operator takes only 10 minutes to paint one of these chassis, readers can get some idea of the speedy work. The photograph at Fig. 4 gives one a good conception of this operation. The doors marked A and B in this photograph swing open after the chassis is painted, when the operator pushes the truck through these doors into the drying oven. Here they go through a drying process, which takes approximately 45 minutes for the frame to pass from one end of the oven to the other.

The Mounting Department

As they come from the other end of this oven the frames enter into what is termed the mounting department. Here they go through various steps of assembly as follows: the bodies are lowered through an aperture in the floor above on to the chassis, when both body and frame are carefully assembled. These bodies are lowered through the floor in a finished condition, having been previously assembled in another department.

Later in this article we shall describe how these bodies are assembled, but for the present we will stick to the routine of operations of the car on its way to completion.

Let us, however, just for a moment, describe the novel way these bodies are lowered.

At certain distances along the second floor there is built areaways or openings through the floor. Of course they are protected from the danger of falling through by means of a built-up partition all around the openings. At each opening is placed two one-quarter ton Morris air hoists, which are so arranged that they will swing even more than the limits of these openings, a hoist being placed at both sides of the hole. In this way bodies can be picked up from either sides of the opening without difficulty.

It is but the matter of a moment to pick up a body, for a special sling is constructed from ordinary pipe, and arranged with quick action catches, so that the description really takes longer than the actual operation of picking up a body, swinging it over the opening, and lowering on to the frame. Next the fenders, running boards, aprons, or skirts as they are sometimes called, are assembled. After this has been completed the car appears as shown at Fig. 5. (Note: This photograph illustrates the F. B. model.)

Final Assembly

The final assemblers now get to work, and go all through and around the car, putting everything in proper shape. The wheels, with tires in place, are now assembled, after which the car is run up on a raised runway as shown at Fig. 6 (also the F. B. model).

Here various other adjustments are made, when the now nearly completed car passes on to still another step. The cover is next placed on the body, after which a final assembly inspection of the now completed car is gone through.

From this point the cars are taken to the test department, where every car undergoes an actual road test before being passed as O. K. Should a defect of any nature show up, the same is remedied at once, and another road test is gone through. In other words, the car must prove on its road test that it is in first-class condition, otherwise the inspector will not pass it for shipment.

It is now forwarded to the shipping department, where it is later placed in the box cars (if the distance warrants such a procedure) and carefully packed and fastened in place. Should the destination of the cars be within a radius of say 100 miles, the cars are usually driven over the road, in place of sending by train. Of course readers can understand that this is a matter which varies, depending on conditions.

As we have now, so to speak, completed the process of assembly, let us consider various other points of interest in the manufacture of different portions of this car.

The Bodies

It is an extremely interesting trip for one to pass through the body assembling building, for here we see various shaped pieces of wood, which, in their raw state, look very unlike automobile bodies indeed. But in a re-

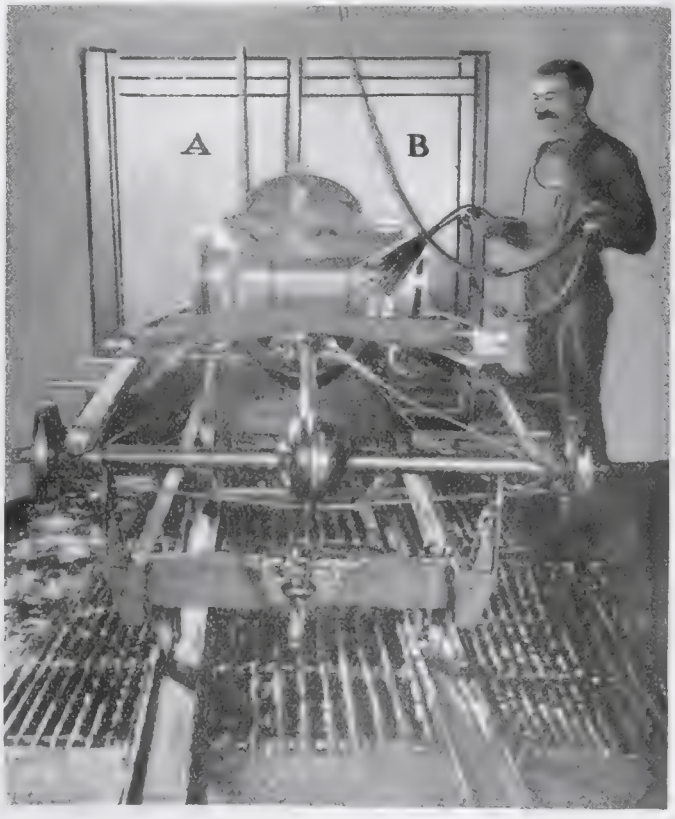


FIG. 4—THE MODEL 490 CHASSIS BEING PAINTED BY THE AIR GUN PROCESS.

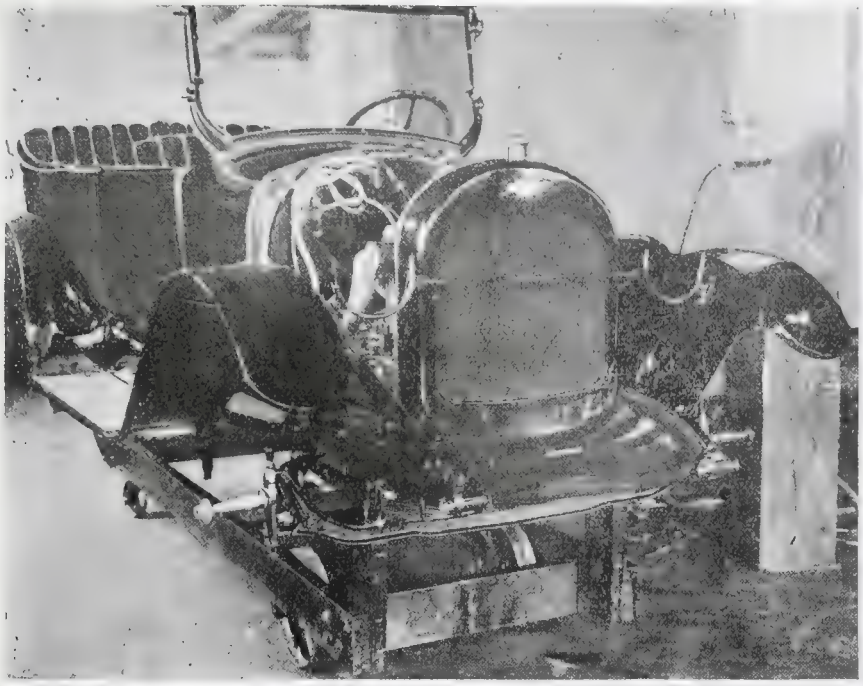
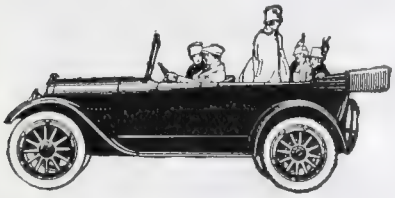


FIG. 5—THE MODEL F.B. CAR IN FURTHER PROCESS OF ASSEMBLY.

markably short time, what a change is seen! Pieces match together almost like magic, and before very long we have a



GENERAL APPEARANCE OF CAR MODEL F.B.

complete wooden framework, of which even the novice could safely venture to say, "That's going to be a body for an automobile."

The next stage is the metaling of the framework, that is the sheet steel coating or covering is carefully nailed on in place. Every stage now improves the body's appearance. The latches, and all other little attachments, doors, etc., are next added.

The upholstery is later installed, and Fig. 7 will give readers a sort of general idea of a small portion of this department.

Welding the Body

Before passing on to any further operations on the body, the writer feels that special mention should be made of the photograph shown at Fig. 8 which illustrates the worker busy welding together the back portion of the body to the side wings, that is the side portions covering the rear seat portion of the car. A special holding jig, as shown, has been made for this purpose, and this scheme has increased production of this work to a wonderful extent. Readers will notice that the photo shows the torch in actual operation.

Painting the Bodies

While it will be impossible to go into the painting in detail, we can at least touch on the various steps of operation, which will illustrate the care that is put on these bodies in order to produce a finish that will stand up under the various weather conditions and rough usage, such as practically all automobile bodies must go through.

First the body is washed with benzine and rubbed down with emery paper, after which a coat of oxide primer is applied. They are now sanded, next colored, then once more re-sanded.

A coat of outside body color varnish is now applied, after which they go through what is termed the Floco process. This Floco, as it is called, is a sort of hollow brush (if one can use such a term) which, on being operated, produces a steady flow of whatever material is being used. On the operation spoken of, the body is Flocoed with green varnish.

They now go to the drying ovens, after which they go to the trimming shop where the black line is painted on at the top of the body, which, to use the shop term, is called "cut-off." They are also striped at this department. To those familiar with the painted appearance of this car, the above remark is self-explanatory, but for the benefit of others it might be best to explain that there is a thin white line carried all around the body portion of the car. This is what is termed striping.

They now go to the finishing room, where they are washed with a mixture of gasoline and water, and lastly, Flocoed once more with a finish coat of varnish.

The advantage of this method is self-apparent, for no brush marks can result from such a finish coating. The bodies for this operation are placed over a huge tray, which catches the overflow material, for to watch the steady flow of varnish which is run carefully all over the body, readers can readily understand the excess material is bound to drip off. For this reason the tray spoken of is absolutely essential.

After being allowed ample time for dripping they are placed in the drying ovens, after which they are complete for the final assembling of the body.

Building the Top

Referring to Fig. 9, which illustrates

FIG. 6—THE MODEL F.B. CAR NEARING COMPLETION.

FIG. 7 -A VIEW OF A SMALL PORTION OF THE ULPHOLSTERY DEPARTMENT.

one of the Baby Grand covers in process of assembly, it will be noticed that these tops are built on a specially constructed framework. The design, as shown, is exceedingly simple, yet such a stand speeds up production to a wonderful extent.

First the bows, as they are called, are assembled, then the Vizor pads, both right and left. Next come the stringers, back curtains, deck, front and back, then the finishing of the raw edge, that is, the complete appearance of the top when finished is in keeping with the rest of the car.

Assembling the F. B. Model

In order to give readers an idea of the motor and transmission assembling for the F. B. car, we illustrate at Fig. 10 two assemblers at work putting this engine together. This photo is practically self-explanatory.

Before closing this description of the Chevrolet plant, perhaps readers would be interested in reviewing the specifications on both the 490 and F. B. models in order to draw a comparison between their sizes, etc., so the following are their chief specifications, which will at least point out the other details of construction which were hardly practical for the writer to touch upon.

Specifications for Model 490 Touring

Motor: Four-cylinder, valve-in-head type, 3 11/16" bore, 4" stroke.
Cylinders: Cast en-bloc (including upper half of crank case). Head detachable.
Valves: 1½" diameter.
Connecting Rod Bearings: 1⅜" diameter, 1⅞" long.
Crankshaft Bearings: Front, 1⅜" diameter, 2 5/16" long; Center, 1 21/32" diameter, 1½" long; Rear, 1¾" diameter, 2 11/16" long.
Camshaft Bearings: Front, 1 5/16" diameter, 2⅜" long; Center, 1 9/32" diameter, 2" long; Rear, 1¼" diameter, 1 7 16" long.
Oiling System: Splash, gear pump and individual oil pockets. Oil pressure gauge.
Carburetor: Zenith improved double jet.

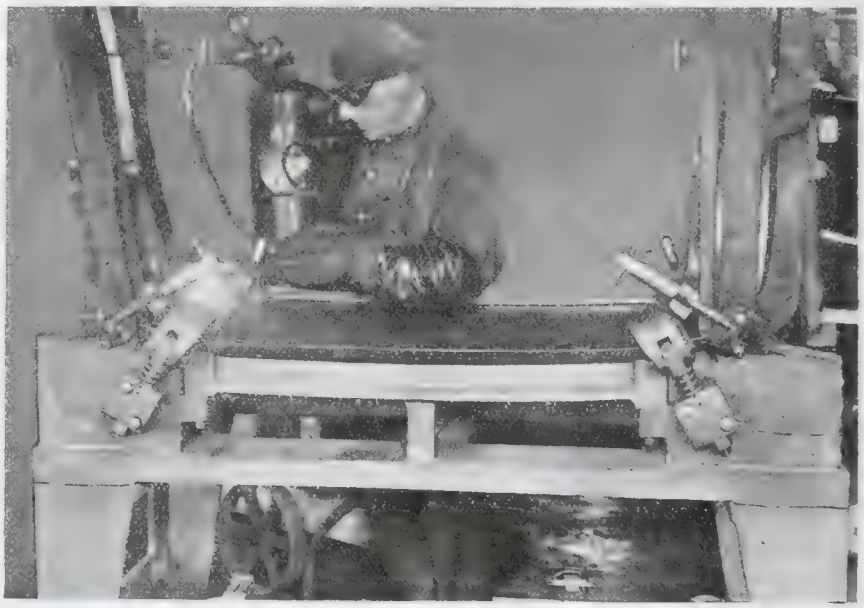


FIG. 8—A CLOSE-UP VIEW OF THE WELDING FIXTURE FOR BODIES.

Ignition: New improved Remy.
Clutch: Cone type with adjustable compensating springs.
Transmission: Selective type, sliding gear; three speeds forward and reverse.
Cooling: Water pump; radiator extra size.
Front Axle: Drop-forged I-beam.
Rear Axle: Three-quarter floating, wheel bearing carried on the wheel-hub and in axle housing, not on axle shaft. Hyatt roller bearings.
Brakes: Emergency, internal expanding type; service, external contracting type 10" brake drums. Foot control.
Wheels: Wood, artillery type, demountable rims, large hub flanges.
Tires: 30" x 3½", non-skid on rear.
Drive: Left side; center control; spark and throttle under steering wheel. Foot accelerator.
Steering Gear: Spur and gear, adjustable for wear. 15" steering wheel.
Springs: Semi-cantilever, front and rear.
Body: Five-passenger Touring Car.
Wheelbase: 102".
Equipment: Electric lights and starter, highest type two-unit system, single wiring used. Complete lamp equipment, mohair tailored one-man top, top cover and side curtains; tilted windshield; speedometer; electric horn; extra rim and carrier on rear; complete tool equipment, including pump and jack. Foot rest, robe rail, pockets in each door.

Specifications of Model F. B.

Motor: Four-cylinder, valve-in-head type, 3 11/16" bore, 5¼" stroke.
Cylinders: Cast en-bloc with upper half of crank case. Head detachable.

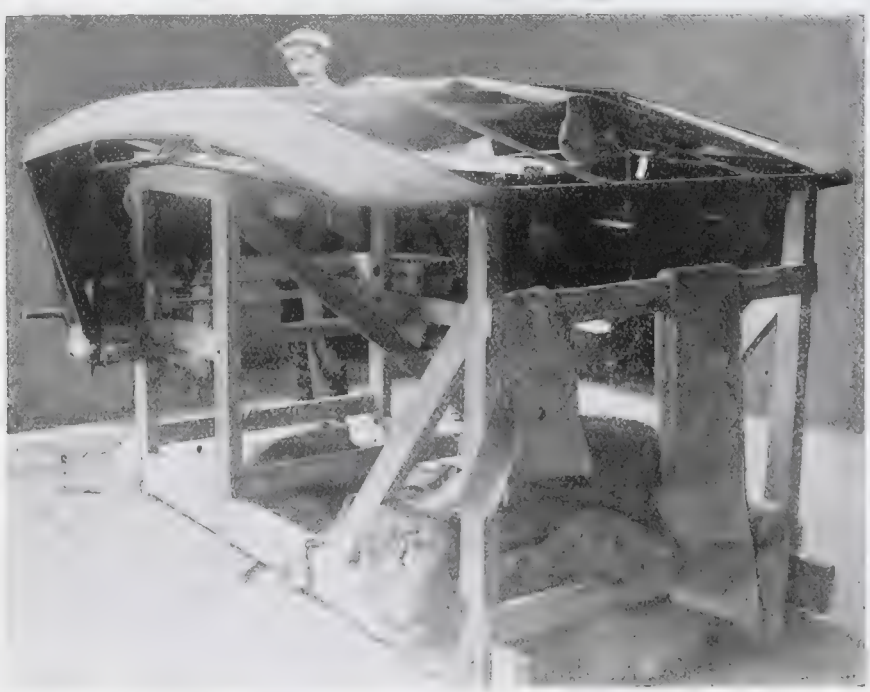


FIG. 9—ASSEMBLING THE MODEL F.B. TOP.

Valves: 1½", enclosed.
Connecting Rod Bearings: 2⅛" x 1½".
Crankshaft Bearings: Front, 2 11 16 x 1½"; Center, 2" x 1 31 32"; Rear, 3½ x 2".
Center Main Bearings: Doehler bronze black.
Crankshaft Bearings: Front, 2¼" x 1 9 16"; Center, 2" x 1½"; Rear, 2" x 1 15/32".
Oiling System: Gear pump. Oil pressure gauge on dash.
Carburetor: Zenith improved double jet.
Electric System: Auto-Lite generator, starting motor, and lighting system. Two-unit type.
Ignition: New improved Remy system.
Clutch: Cone, leather faced, with adjustable compensating springs.
Transmission: Selective type, three speeds forward and reverse.
Front Axle: Drop-forged I-beam with integral yokes. Wheels fitted with New Departure ball bearings.
Rear Axle: Three-quarter floating type. Shafts run on Hyatt roller bearings.
Cooling: Water pump; radiator extra size.
Brakes: Service, external contracting; emergency, internal expanding (hand-controlled); 12" brake drums.
Springs: Front, semi-elliptic; rear, semi-cantilever.
Tires: 33" x 4", non-skid on rear. Plain tread on front.
Drive: Left side, center control.
Steering Gear: Worm and gear wheel, 17" steering wheel with inserted spider.
Gasoline Supply: Seventeen-gallon tank hung on rear, with gauge. Stewart vacuum system.
Wheelbase: 110".
Equipment: Electric lights and starter; highest type two-unit system, single wiring used. Complete lamp equipment, including headlight dimmers; electric horn; speedometer; demountable rims, with extra rim; tire carrier; license holder.

In conclusion, let us for a moment consider production figures. A year's production at this plant means twenty thousand completed automobiles, which give one a real idea of the splendid system and routine which has been installed. The gentleman who accompanied the writer on his trip through this plant remarked: "Yes—and we will no doubt do still better as time goes on," which shows clearly, that although this plant is run on a good systematic basis, still the watchword is "Increased production" all the time.

Perhaps at a later date CANADIAN MACHINERY may be able to secure valuable material for their readers in regards to the cost and production system as employed by this up-to-the-minute concern.

FIG. 10—ASSEMBLING THE MODEL F.B. ENGINE.

The Electric Furnace and the Non-Ferrous Metals

The Following Paper Was Read by the Author Before the Cleveland Engineering Society on March 11. The Utility of the Electric Furnace for the Melting of Non-Ferrous Metals and Their Alloys is Clearly Developed

By E. F. COLLINS, General Electric Co.

Continued from June 19th issue

IN fact even though melted under a charcoal cover and CO blanket, copper needs a deoxidizer to free it completely from oxygen. The above troubles should not appear in connection with electric melting, since the furnace chamber may be kept uncontaminated and free from oxygen and injurious gases.

Fifth Source of Melting Loss

Loss of zinc is proportional to the temperature and length of time a metal is held at the high temperature. This statement means that if you melt one charge at the rate of 100 lbs. per hr., and the second charge at the rate of 200 lbs. per hr., then, all else being the same, the melting loss of second charge will be less than the first charge. Electric methods of melting lend themselves to much quicker melting or higher melting rates than with fuel fired furnaces, viz., melting rate electric, 1,500 lbs. per hr.; fuel fired, 1,500 in 2¼ hrs.; 600 lbs. electric in ½ hr.; fuel fired, 600 lbs. in 3 hrs.

Determination and Measurement of Metal Loss

Metal loss in melting is ordinarily best judged from chemical analysis of metal charged. This test eliminates errors arising from furnace wall absorption or the reverse, also losses in pouring.

To show the inconsistency of actual recovery methods of loss test, the following results of comparative tests on coal fired crucible furnace and electric furnace (crucible capacity 250 lbs., electric furnace capacity 1,500 lbs.) are presented. Metal was poured from crucible direct, whereas auxiliary ladle was used to pour 1,500 lbs. electric furnace, giving chance for more loss in pouring.

METAL RECOVERY TEST
(Actual test on Red Brass.)

Metal Charged	Metal recovered	Loss %	Type Furnace
1 heat 1500 lbs.	1465 lbs.	2.33	Electric Tilting
1 heat 1500 lbs.	1484 lbs.	1.07	Electric Tilting
4 heats 250 lbs.	980 lbs.	2.00	Coal fired crble.
4 heats 250 lbs.	990 lbs.	.85	Coal fired crble.

Chemical analysis for melting loss on the same electric furnace, and same metal showed approximately .4% Zn. loss.

Analysis of metal charged:—

S.N.	Pb.	Cu.	Zn.	Fe.
4.30	6.55	80.80	8.02	.25
4.29	6.60	81.46	7.61	.25
(Poured ele.)		(No charcoal.)		

ACTUAL TEST (YELLOW BRASS) ELECTRIC FURNACE.

Metal Recovery Test.

Metal Charged	Metal poured	Loss
600 lbs.	590 lbs.	1.6 %

Analysis Metal Loss.

Charged Cu. 70	Zn. 30	
Poured Cu. 71.3	Zn. 28.6	1.4 %

ELECTRIC FURNACE MELTING PHOSPHOR BRONZE.

Metal Recovery Test (Actual)—
Metal charged, 2696 lbs.; metal poured at 1100° C, 2656 lbs. Loss, 1.4%.
Metal charged, 3727 lbs.; metal poured at 1200° C, 3678 lbs. Loss 1.3%.

Physical Test of Metal—

Open flame oil furnace and electric furnace melting same brass.

	Elec. Furnace	Oil Furnace
Ten. Strength	27900	24969
Yield Point	10844	9850
Elas. Limit	7300	7000
Elong. in 2"	19.4%	16.9%
Elong. in 8"	17.2%	14.9%
Red. Area	21.4%	19.7%
	Crucible Furn.	**Elec. Furn.**
Ten. Strength	30250	30820
Elas. Limit	17833	18000
Elong.	16.14%	19.37%
Red. of Area	16.1%	22%

Tables 3, 4 and 5 show performance on the average to be expected from the use of the electric furnace with the furnace charge in different physical form, etc. Table 6 shows like results for fuel fired furnaces.

TABLE NO. 6.

Average Melting Results, Realized in the Average Foundry with Fuel Fired Furnaces.

Type	Furnace Draught	Fuel Kind	Per Ton.	Metal Loss	Red Brass Low Zn. 10% Yellow " High Zn. 10% above
Pit	Nat.	Coke	1400 lbs.	3.5	Red Brass.
			1000 lbs.	5	Yellow Brass.
Pit	Forced	Coke	700 lbs.	1.5	Red Brass.
			600 lbs.	2	Yellow Brass.
Tilting	Forced	Coke	600 lbs.	1.5	Red Brass.
			400 lbs.	2.5	Yellow Brass.
Pit	Nat.	Coal	1200 lbs.	3.5	Red Brass.
			700 lbs.	5	Yellow Brass.
Reverb.	Nat.	Coal	900 lbs.	6.2	Red Brass.
			400 lbs.	10	Yellow Brass.
Pit	Bumers Tangentail	Oil	50 gal.	1.5	Red Brass.
			40 gal.	3	Yellow Brass.
Tilting	Open Flame. Atomizing Bumer.	Oil	60 gal.	3.2	Red Brass.
			45 gal.	3.5	Yellow Brass.
Tilting	Bumers.	Nat. Gas	4800 cu. ft.	2.75	Yellow Brass.
Crucible	Tangentail.				
Tilting	Bumers.	City	7000 cu. ft.	2.75	Yellow Brass.
Crucible	Tangentail.				

TABLE NO. 3.

Nonferrous Metals Melted in Electric Furnace.

Metal	Condition of Metal Charged.	State of Metal After Melting.	KW. hrs per Ton to melt.	Metal loss in melting.
Copper	Electrolytic Cathode Pig Scrap—Heavy. Scrap—Light. Scrap—Dirty. Chips—Oily. Chips—Clean.	Pig at pitch without rabbling or poling Wire bar. Foundry Castings.	300 to 500	No oxidation; a certain amount of copper oxide is reduced.
Zinc	Electrolytic Cathode Pig. Punchings. Chips. Heavy scrap	Pig. Foundry castings. Billets for rolling. Battery electrodes.	90 to 120	Dross and Oxidation under 2%.
Nickel	Shot. Bar. Scrap.	Pig. Foundry castings. Billets for rolling.	500 to 750	No oxidation loss.
Alum.	Pig. Scrap. Punchings. Turnings.	Pig. Foundry castings. Billets for rolling.	400 to 750	Less than 1% oxidation.
Tin	Bar. Pig. Scrap.	Bar. Pig. Wire.	40 to 60	No oxidation.
Lead	Pig. Scrap. Sheet.	Billets for rolling. Casting. Pig.	20 to 40	No oxidation.

TABLE NO. 4.

Nonferrous Alloys Made in Electric Furnace.

Metals	Condition of metal charge.	State of Alloy after melting.	KW. hrs. per Ton.	Metal Loss.
Red Brass –				
Cu. 80	Scrap pig, electro. cathodes.	Foundry castings.		
Zn. 10	Scrap—bar.	Wire bar.	250 to 400	.25 to .7, depending upon manipulation of furnace.
Sn. 6	Scrap—pig.	Billets.		
Pb. 4				
Yellow Brass—				
Cu. 60	Scrap, Pig, Electro. cathodes.	Foundry castings.	220	
Zn. 39.5	Scrap, Pig.	Wire bar.	to	.50 to 1.5.
Pb. 00.5		Billets for rolling.	350	

TABLE NO. 5.

Alloy.	Condition of alloy charged.	State of alloy after melting.	KW. hrs. per Ton.	Alloy Loss	Temp.
Red Brass	Yellow brass and copper or Red Brass and Zinc Pig Scrap and sprues, turnings and chips.	Foundry castings. Wire bar. Billets.	225 to 300	.15 to .50	1300°
Yellow Brass	Red Brass and Zinc or Yellow Brass and Zinc Pig Scrap and sprues, turnings and chips.	Foundry casting. Wire bar. Billets.	200 to 275	.40 to 1.00	1100° C.
Monel					
Copper Nickel	Scrap and billets.	Foundry casting. Billets.	500 to 750	No oxidation.	1600° C.
Aterite Cu.	Sprues, Scrap. Ni. Virgin metal. Zn.	Foundry casting. Billets for Drawing Rolling.	500 to 750	2% zn. loss	1650° C. Out of 32%.

The results given in tables 1 to 4 are average figures and will be influenced to meet any particular foundry by (a) promptness of pouring, (b) temperature (since pyrometers are seldom used), (c) local conditions such as physical condition of metal charged, its cleanliness, volume of air and products of combustion which pass through the furnace in natural draught furnaces. This varies from day to day, depending on the weather, (d) design of furnace, (e) manipulation of furnace, (f) size of crucible, (g) percentage of composition, (h) length of working day, (i) whether observations are based on hot furnace and hot crucibles or whether first heat of the day is excluded, (j) pouring light castings require hot metal, and heavy ones metal at lower temperature, (k) whether results are from careful tests or whether they represent actual foundry or rolling mill practice and extend over a considerable period.

Chart 4 illustrates how a furnace able to turn out metals for 300 kw. hr. per ton, due to foundry handicap, averages only 350.

Cost of Melting Brass in Fuel Fired and Electric Furnaces

The speaker presents table as a resume of that which precedes it in the paper, relating to cost of melting brass per ton with the various typical fuel fired furnaces, and also with the electric brass melting furnace. This table is an average table and results for individual foundries may be readily found by substituting in the itemized costs those which obtain there, i.e., .5 cents per kw. hr. has been used as electricity or power cost, if this is 1 cent in plant under consideration then this figure should be substituted. Likewise other values may be converted to actual ones for an actual local condition. It is believed that the values used in this table are fair and represent well averaged conditions, and they may be considered directly without substituting for local conditions, in fact, in their direct form they allow of judging correctly of the general problem of electric vs. fuel fired furnaces.

Final

In conclusion permit me to present chart No. 1, made up from the other curves and tables. Here I have assumed that all the brass in the country is melted (1) in fuel fired furnaces, all types being employed equally, (2) that the same work is done in the electric furnace.

Four conditions are shown, viz.:

10-hr. day (1) melting yellow brass; (2) red brass; 24 hr. day, (3) melting yellow brass, (4) red brass.

The shaded portion of each wedge

Continued on page 12

Various Examples in the Art of Gauge Making

To Make a Good Gauge Necessitates Considerable Skill. Herein is Shown Various Examples of This Interesting Branch of the Machine Tool Industry

By H. G. ROBSON, A.M.I. Mech. E.

GAUGE-MAKING, the most highly skilled branch of engineering, should be a very interesting study to all students of engineering. It reveals an interesting amount of geometrical and mathematical knowledge, and a skilled worker, having acquired the latter, must necessarily possess an advantage when undertaking the design or construction of difficult types of gauges.

The following examples of gauge-making are more or less of a straightforward kind, and they have been chosen to reveal the modus operandi of the gauge-maker rather than the extent of calculations required. Nevertheless, these examples show many neat devices for executing work that may be generally regarded as difficult. In Fig. 1 a plate gauge is shown with a limit of ± .0005 in. In order to appreciate the beautiful principles of "limits," the nominal sizes, as given, should be worked to. The first step is to make a hob, as in Fig. 2, by which the gauges can be gashed or roughed out. To allow for distortion during the hardening and tempering of the hob all the diameters of it must be made so as to make the depths of the semi-circular parts of the gauge greater, and the width of the slots less than the nominal figure. A small plate gauge would have to be made, as in Fig. 3, for making the semi-circular portions of the hob. The hob is made hollow, and the outer ends of the hole are tapped for securing to a suitable holder. A portion is then ground away, so as to leave a face F radially, as in Fig. 2. If the hob is correctly made the cutting face will be a section plane passing through the centre.

The check piece must now be made to finish the gauges by. It is shown in Fig. 4, marked C, and its application to a gauge G is shown. When the gauge is finished, the surfaces of the check and gauge should be light tight. This test is made by placing the two parts in Fig 4 against a piece of glass, holding them to the light. The check has two pieces, marked 1, fitted into two slots, and securely held in the same plane to the body of the check by a cover plate. The two curved pieces must project above the body by $.082 + \frac{.15}{2} = .157$ in. The body of the check must therefore be made parallel to a measurement, say, 1 in. By measuring from the lower edge the micrometer should read 1.157 in. as shown. Considerable skill is required to make a check of this type. It is very rigid, and by modifying the cover plate with slots, the pieces 1 could be raised to give various heights above the top edge. The check should be a good fit to the gauges before they are hardened, otherwise it will be found difficult to secure that the surfaces are light tight.

The gauge in Fig. 5 reveals exceptionally interesting work. The check will appear as in Fig. 6. There are two pieces A and a third piece B securely held in the body of the check. Having decided upon the design of the check, the first step will be to find the breadth b, Fig. 6, of the piece B. In Fig. 7 the particulars are set out. We have

$1.05^2 = .689^2 + w^2$,

$\therefore w = \sqrt{1.05^2 - .689^2}$,

$\therefore w = .792$ in., and breadth $b = 1.584$ in.

It will now be necessary to make piece B, and it is important to have the two sides equidistant from the dotted centre line in Fig. 6. A disc—Fig. 8—is bored and lapped to 1.05 in. radius. A circular plate is then turned and lapped to 1.05 in. radius. A segment is then made from this disc so that its height, 1.739 in., corresponds to the one edge of piece B of the check. By applying a straight-edge to the faces in Fig. 8 observations may be made for final testing of these faces. The piece B is cut from the disc, and its width 1.548 in. is worked up from the true face first determined. It will now be necessary to true the bottom face square with the sides. The heights of pieces A of the check must correspond to the height A in Fig. 9. There is danger in working from this sharp edge, and the actual height of A is best found by finding B. By holding a lapped pin, as shown, the height C is given, and from it B is found. Assume $B = 1.14$ in., then $A = 1.14 + .361$ in. (Fig. 7) $= 1.501$ in., which is the measurement for the two pieces A in Fig. 6. Finally the overall heights in Fig. 6 must be checked from the base, because the inner face of the check is .4 in. and parallel to base. The top face, marked by measurements D, is then made so as to permit pieces A to project by .55 in. These pieces must be rectangular and fit tightly in the body of the check.

Interesting principles are embodied in the gauge shown in Fig. 10, which represents a plate gauge of three sizes, having the .43 in. measurement out of centre by .0015 in. The plate should be made parallel as in Fig. 11, so that A C and B D are 1.235 in. The faces shown by the dotted lines are then parallel to A B. The first measurement will be $\frac{1.235 - .721}{2} = .257$ added to $.721 = .978$ in. The last size is $\frac{1.235}{2} + .0015 + \frac{.43}{2} = .834$ in.

The widths, .721 in. and .43 are then made from the true faces. As distortion may follow the hardening process, a check must be made so as to secure centrality of the first two sizes, and the amount of eccentricity of the .43 in. width. The check is shown in Fig. 12 applied to one side of the gauge. By making a parallel piece of plate, say, .704 in. wide, the other size can be found to give the correct position of the faces. This check cannot be used for the opposite faces, but they may now be tested by using the micrometer to determine finally the respective widths.

The gauge shown by Fig. 13 includes much work that is typical of the tool room. It is no simple piece of work, and requires a great deal of skilful manipulation. The work, when released from the drill jig, will be near to what is required, and the allowance upon the diameters of the .122 in. holes will then permit them to be worked up to their size, pitch and amount off the centre line. There are two .122 in. holes at right angles, having a pitch of .36 in., and situated .004 in. off the centre line of gauge, and .331 and .691 in. respectively from one end face. It is proposed to use a jig for drilling purposes, as in Fig. 14. There are two bushes, A and B, for drilling in from one side, and two others for meeting these holes in the centre. The hole in the block should be gauge size, so that the gauges will be securely held by fitting tightly. The first step will be to make the faces C D, D E, E F, F C at right angles to each other and true and square with one end face. It will be necessary to have the edge of the square for testing in good condition, and it may be necessary to finish it off by oil-stoning. One face for measuring from is made at right angles to the axis of the hole by securing a gauge mandril in the jig block, as in Fig. 15, and testing. The next step is to find the position of the centre punch marks for drilling holes for bushes B. The block is lettered to show clearly the method adopted. First the height of the centre of the hole for gauges above the base F E is found. By using small plate gauges with a slight taper under the parallel mandril, as in Fig. 16, and adding the radius of the mandril to that measurement, the position of the axis is located. A counter check of this position should be made, as in Fig. 17. Place a small lapped pin in the hole, and by the micrometer ascertain measurement B. From this deduct the diameter of pin, and height A is found. This height added to the radius of the mandril should agree with the previous measurement. Let us assume that this height comes to 1.238 in., as in Fig. 16. As the hole is .004 in. off centre in

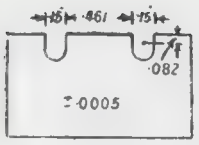


Fig. 1.

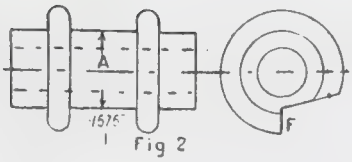


Fig 2

Fig. 3

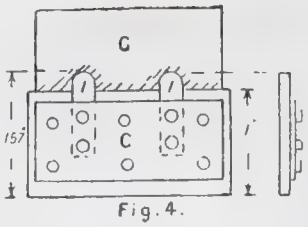


Fig. 4.

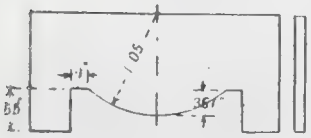


Fig. 5

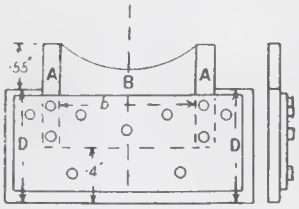


Fig. 6.

Fig 7.

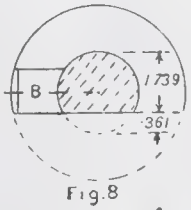


Fig. 8

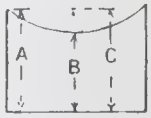


Fig 9.

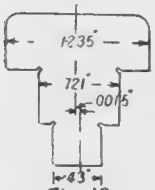


Fig. 10.

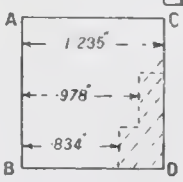


Fig 11

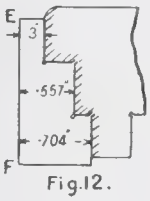


Fig. 12.

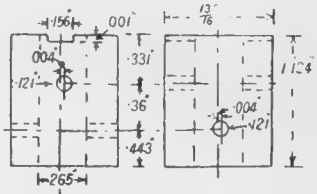


Fig. 13

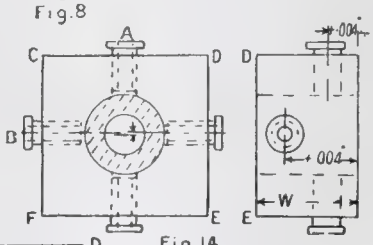


Fig. 14.

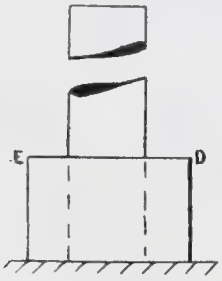


Fig. 15.

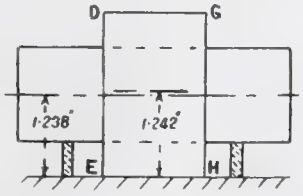


Fig. 16.

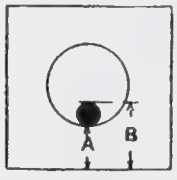


Fig. 17.

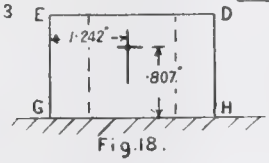


Fig. 18.

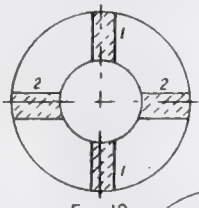


Fig. 19.

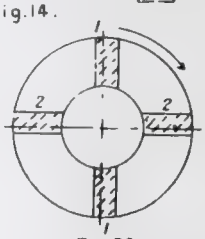
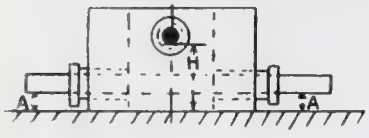


Fig. 20



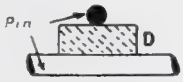


Fig. 22.

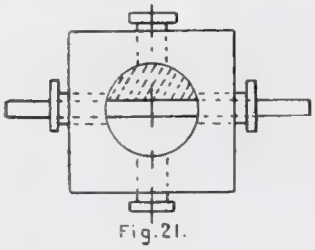


Fig. 21.

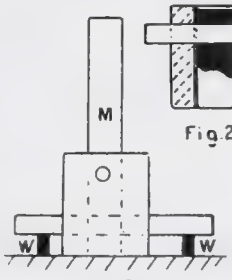


Fig. 23.

Fig. 24.

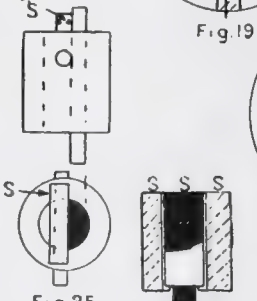


Fig. 25.

Fig. 26.

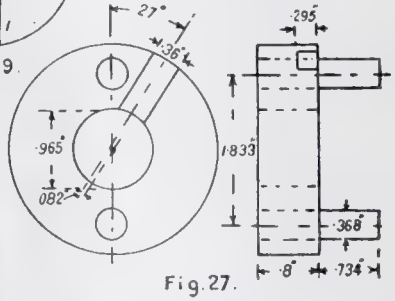


Fig. 27.

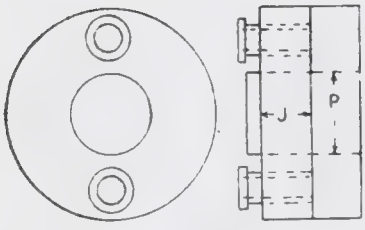


Fig. 28.

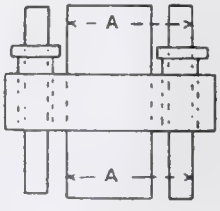


Fig. 29.

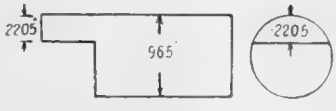


Fig. 32

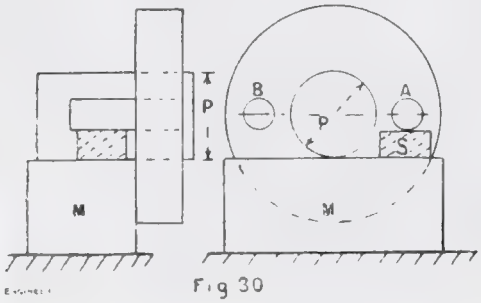


Fig 30

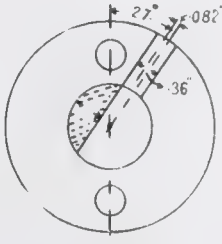


Fig 31.

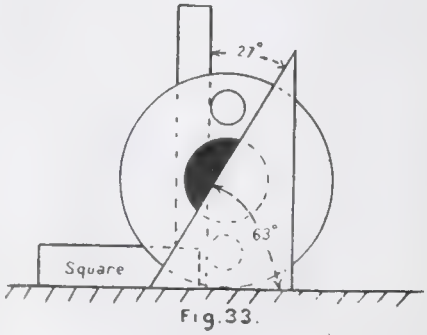


Fig. 33.

SKETCH SHOWING FIGS 1 TO 33.

Fig. 13, the height in Fig. 16 will correspond to 1.238+.004=1 242 in.

By the aid of a magnifying glass, and using a scribing block and steel rule, a line is marked at this height upon the end faces—that is, D E and C F. The position of the centre punch along this line in Fig. 16 is .443 + .36 = .803 in. from line G H. In Fig. 14 .004 in. are being allowed for finishing the end faces of the gauges, therefore the measurement becomes .807 in., and is marked off as in Fig. 18, but upon the two faces opposite each other. Here again a magnifying glass and a rule divided into hundredths of an inch should be used. Whilst the block is in the position shown in Fig. 18, a line for the pitch of the holes should be marked. The holes are .36 in. apart, therefore the next line will be .807 in. —.36 in. = .447 in. This height can now be marked off, but upon the faces C D and E F, at right angles to the faces, already marked. The face C D should then rest upon the face plate, because the holes now being dealt with are shown .004 in. off centre line in the plan of Fig. 13. This is important, for it is possible to secure that the .121 in. holes shall be .004 in from the centre lines, but by a slip the relative position of the slot may be incorrect. This effect can be better understood by reference to Figs. 19 and 20. Fig. 19 shows a plan of the gauge where the holes should be. In Fig. 20 hole 2 is shown drilled the other side of the centre line. If Fig. 20 is turned 90 deg. in a clockwise direction, the position will correspond with Fig. 19, but hole 2 for that position must be near the end where the slot is. If the gauges were not corrected at once they could not be saved, even if the ends, as it were, were changed over. The intersection of the marked lines having been marked by a centre punch, the mark should be re-examined by a glass to see its position more clearly, and any adjustment, if necessary, made. Four holes can now be drilled in from the positions on the faces. The diameter should be about .004 in. less than the finished size., viz., .117 in. The holes should now be enlarged by a pilot drill, so that there is about .1 in. of metal at the bottom of the enlarged hole. Bushes are turned as shown, their holes being .117 in. diameter. A slight lead upon the diameters of bushes is helpful. There is sure to be some adjustment necessary, even though accuracy has been the aim of the jig worker. By applying ground pins .117 in. diameter. it will be seen how the axes of the bushes are situated, and, finally. the pins should point correctly, be parallel to base as at A and H—Fig. 21—and be correctly set off centre .004 in. The gauges are 13-16 in. external diameter, but owing to precision required they are turned .8125 in. diameter. A segment piece about 2 in. long is then made to the shape shown in section in Fig. 21. Its thickness varies by .0005 in. throughout its length. Its mid-thickness will be.

$$\frac{.8125}{2} - \frac{.117}{2} + .004 = .40625 - .0625 = .34375 \text{ in}$$

This is the radius of the hole in the jig less radius of pin plus amount off centre. It will be found a little difficult to arrange the bushes so that their positions are properly situated, although in Fig. 21 the method shows that the bushes are located for position by measuring a reasonable distance from the centre of the jig. After all, it is the position of the pins in the centre hole—.8125—that really matters. So, while it is practically convenient to measure outside the jig, yet the pitch of the pins can be tried near the centre by placing in the jig a disc made the measurement between the inner surfaces of the pins. In Fig. 22 this disc D is shown resting between the pins.

Having made the jig correctly, it will be very necessary to turn the gauges carefully so that the .263 in. hole is concentric with the outside surface. As a matter of fact, one mandril for turning the gauges upon it is not sufficient. It is found during the roughing stage that the mandril springs, and often, if not hardened, take a permanent deflection It is therefore the better plan to remove th final .01 in. by using another mandril. It should be remembered that there are so many points that should finally agree when the gauges are finished that any small errors in the jig or in the preparatory stage of the gauge should be at once corrected. It is the cumulative effect of several little errors that often makes a straightforward piece of work an exceedingly difficult one.

The drilling will have to be executed by specially turned drills. A flattening drill is first used, a centre drill then follows, and then the drill .005 in. less in diameter than the centring drill makes the holes in the gauges. A series of pins, ranging from .004 in. less than the finished-size holes, by one-thousandth to .12 in., is now required. During the drilling stage the .263 in. hole should be plugged in all cases. After the gauge is drilled, one of the series of pins should be placed in the gauge. Then by means of the rimers the position of the holes are determined, as regards pitch and amount off centre. The distance of the end of gauge from pin is finally made by working the end face up, so that mandril M in Fig. 23 is square with base and the heights W agree. Having made one gauge carefully, a centre plug should be made so as to fit in the gauge upon one pin. The end face of this plug should be lapped so as to be level with the end face, as shown in Fig. 24. The end faces can then be determined by this plug more correctly than from the outside of the gauge. When one face is determined, the length of 1.134 in. can be made. With regard to the slot, it is necessary that the centre line of the .263 in. hole should coincide with centre line of slot, and the slot be parallel to the hole near it. By using the segment piece—as in Fig. 25—it can be calculated how wide the slip S will have to be so as to come to one side of the slot and fit in position. As soon as one side is finished, the slot is then made .156 in. wide by another slip. This arrangement also secures the slot being parallel to the hole near it. The slot is .011 in. deep. A gap gauge to fit over the slot and bottom of gauge is not a neat enough check. A better plan is to make a plug to fit inside the gauge so that it is (1.134 —.011) = 1.123 in. long. By inverting the gauge and supporting it so that the plug rests upon a level with slot—as in Fig. 26—the depth of slot can then be tested. The slot is .011 in. deep when the three surfaces S are level. The gap gauge mentioned would be 1.123 in. wide, and could advantageously be employed to test parallelism, whilst the depth is being worked up.

A different type of gauge is shown in Fig. 27. Here there are two .368 in. pins projecting .734 in. above the face of the disc. They are situated upon a centre line of the .965 in. hole. A groove .36 in. × .295 in. deep has its axis inclined at 27 deg. to the axis passing through the pins. The centre line of the slot is .082 in. off the centre of the .965 in. hole. The jig will consist of a ring—as in Fig. 28—having a .965 in. hole. When in use a .965 in. plug secures the jig and gauge for alignment. In making the jig, the holes are carefully marked off, enlarged and then bushed. By placing pins in the bushes —as in Fig. 29—the radial distance of centres can be tested by finding the measurement A. In addition, tests must be made for determining that the centre line of the pins passes through the centre of the .955 in. hole. The arrangement shown in Fig. 30, although used for testing the pin holes after drilling, can be used also for testing the holes in the bushes. Here the gauge is supported up against the true block M by a .925 plug and the face of gauge. The slip piece S is made to its correct size, viz.,

$$\frac{.965}{2} - \frac{.368}{2} = .2985 \text{ in.}$$

When the pin B is correctly situated on the centre line, another slip, the same size, must just fit—as is shown for pin A. In order, therefore, to determine correctly the position of the pin holes, the holes must first be drilled .004 in. smaller than finished size. This is not a large amount, since the gauge is .8 in. thick, and if the holes are not square it is possible this allowance may be used up without assuring that the holes are square to the face. In addition to this, the measurement corresponding to A in Fig. 29 must be noted, as the pin hole is gradually enlarged to its final size. The enlargement is done in steps by using pins varying by .001 in. The position of the slot must now be determined. We first require the depth of the segment in Fig. 31 included between the .965 in. hole and one face of the slot. This will be

$$\frac{.965}{2} - \left(\frac{.36}{2} + .082 \right) = .4825 - .262$$

.2205 in.

This segment must fit solid with a .965 in. plug shown in Fig. 32, by removing the metal as indicated. By this means the segment will occupy its position in a better way than if it were

separate. To use the segmental check piece, first place the two pins in the gauge projecting from the other face, and set them square—as illustrated in Fig. 33. The gauge should then be rigidly fixed, whilst the plug with the segment piece is placed in and twisted until the face of segment is parallel and touching the 63 deg. face of a set-square. Lines should then be marked on the face of the gauge, each side of the .965 in. hole. This enables direction of the face of slot to be easily found. The width .36 in. of the slot can now be marked off. The slot can be milled and finally ground, the face for the segment piece being finished first. The depth .295 in. can be found by making the depth of metal under slot .8—.295 = .505 in. by the micrometer. The height of the pins, .734 in., is found by making a washer to slip over the pins, and .734 in. thick. The end of the pins must be level with the washer face.

WOMEN AND STEEL ROLLING

By L. P.

The introduction of female labor in the Clay Wheel Rolling Mill at Wadsley Bridge has created some interest in industrial circles because it has always been held that the tasks in the mills are beyond the capacity of women, besides being unfit for them to do in many ways. The work done at the Clay Wheel Mill is of an exceptional nature, and far from being typical of general rolling such as is carried on in the Sheffield district. Consequently the experiment, however successful, does not possess much significance, and is not likely to be extended. We learn that the women are merely assisting in rolling 50 lb. billets into rods, and the work changes but little. Moreover, it is light, and comparatively simple. The conditions, in fact, are quite unusual. The work at the other mills, on the contrary, is not only extremely laborious for the most part, but highly varied, being often complicated, difficult, and dangerous, whilst a good deal of it requires a great amount of skill. It necessitates the handling of heavy pieces of red hot steel—a task which no girl could perform, nor should be allowed to do so if she were able. Such conditions necessitate the employment of a staff capable of dealing with the heaviest jobs. People in the rolling trade do not admit the practicability of diluting labor in the mills with women, and, indeed, few of the shops could be adapted so as to enable women to work in them in decency, safety and comfort. Moreover, no one having respect for our womanhood would care to see females working alongside men in rolling mills, where the coarseness of the prevailing manners and habits is notorious. Where the conditions resemble those at Wadsley, however, women may be employed without evil results, but authorities on the subject declare that such application does not come within the range of practical politics. Steel rolling is essentially men's work, and some people even think it is scarcely white men's work.

DRIVING BELTS

By M. E.

Many lose power and waste fuel because their driving belts travel far too slowly. This is readily appreciated by observing that the power transmitted by a driving belt (in h.p.) is found by multiplying the speed of the belt by the working tension, and dividing the result by 33,000. In other words, double the speed will give twice the driving power, and three times the speed will give three times the driving power, and so on.

For heavy drives, such as those used in brickworks, for all the main machinery the belts should run at an average speed of between 3,000 and 4,000 feet per minute, the higher figure being regarded as high by many engineers, yet satisfactory if the pulleys are properly aligned and the belt is cut truly and well made. In any case, the makers of the belt will usually advise as to the best speed at which it will run, and this speed should be made use of in planning or altering the machinery. If this is attempted it will be noticed how far short some of the well-known brickmaking machines are in this respect. For instance, a grinding pan will usually do its work most efficiently when the upright shaft with the runners makes about 25 revolutions per minute. With crown and pinion ratio of 8.1 this means that the driving shaft or pulley carrying the pinion must make 200 revolutions per minute. Assuming that this machine is belt-driven, with a 4 ft. pulley, the belt speed would be only 2,500 ft. per minute, so that to get the best results from the belt a pulley 6 ft. in diameter would be required.

In driving some brick machines of the ordinary wire-cut type, it is customary to use 3 ft. driving pulleys which make 18 revolutions per minute, lamentable waste of power being thus lost by the belt being run at far below its most efficient speed.

The main drive is often correspondingly faulty, particularly if a rope drive is used. Under ordinary conditions a rope works best at 4,800 feet per minute, which, on a 20 ft. driving pulley corresponds to 76 revolutions per minute, other sizes of pulley requiring equivalent revolutions.

The speed of belts is easily tested by making a chalk line about an inch wide across the belt and noting how many times in a minute the line passes a given spot, which can be readily seen at the same time as the belt. The number of revolutions multiplied by its length will give the velocity of the belt. Another method is to count the number of revolutions made in a minute by one of the pulleys carrying the belt and multiply by three and one-seventh times the diameter of the pulley in feet; this method is, however, open to the objection that the belt may slip on one or other pulley so that the speed of the belt and the pulley do not coincide as they should do.

It will be seen that a study of the speeds of the different belts in a works is well worth very careful attention, and where the speed can be increased to between 3,000 and 4,000 feet per minute without undue alteration in plant the change will be well worth while. It should be noted, however, that merely to increase the speed may be undesirable as it may result in speeding up some of the machines, and this may lead to disaster. As far as possible the standard rates of running the various machines should be retained, the increased belt speed being used chiefly in reducing the coal bill.

It sometimes happens that a belt is run slowly because at a higher rate it would run off the pulleys; in such a case the machines should be put into proper alignment by adjusting the bearings carrying them and the relative shafting. To run a belt slowly merely because it runs off the pulleys is unwarranted waste in these difficult times, and it ought to be stopped at once, especially as the adjustment is usually neither difficult nor costly.

The use of too narrow a pulley or too small a belt, or the improper position of the pulleys relative to each other, may also cause serious loss of power and therefore need periodic attention, and a little time spent in checking the sizes of the belts and the speeds at which they run, as compared with the really best dimensions and speeds will be well repaid, because it will show clearly wherein money is unexpectedly lost.

THE ELECTRIC FURNACE

Continued from page 8

shows the saving in total cost between melting with fuel and with electricity.

This chart stated in words and figures is as follows:

Furnace	Alloy	Length Melting Working day	Per cent. savings over fuel fired
Electric	Yellow Brass	10 hours	100%
Electric	Red Brass	10 hours	80%
Electric	Yellow Brass	24 hours	110%
Electric	Red Brass	24 hours	700%

These margins of savings are of such magnitude that we cannot longer doubt that the electric furnace is destined to dominate the brass melting field.

ANOTHER DRYDOCK FOR THE ST. LAWRENCE

The Leclair Shipbuilding Company, of Sorel, Quebec, are about to commence the construction of a floating drydock that will have a capacity of seven thousand tons. This will be large enough to float most of the vessels using the St. Lawrence River.

The company is busy at present on the construction of six steel trawlers and six 1,300 ton capacity wooden schooners, fitted with auxiliary engines.

WELDING AND CUTTING

Various Jigs as Applied to the Welding Trade

Some Examples of Welding Jigs and Methods for Overcoming Distortion Are Taken Up by the Author, Who Presented This Paper Before the British Acetylene and Welding Association.

By B. S. MILNE

AS I have, during the past ten years, been responsible for the manufacture and repair of innumerable articles by the oxy-acetylene welding process, I felt it to be my duty, as a member of this association, to respond to our president's call at the last meeting, and volunteer to write this paper relating some of my experiences regarding these operations. I have also written it with the hope that I may be imparting some useful information to the members, and that it may produce a great deal of useful discussion upon these matters.

I have chosen as my subject "Some examples of welding jigs and methods for overcoming distortion."

In my opinion the questions of jigging and overcoming distortion are, so far as new work is concerned, so intimately connected with what I shall call "design suitable for welding" that I shall endeavor in my examples to point out what I consider are, and what are not, "designs suitable for welding."

In repair work the question of design does not arise; that has already been settled by the maker of the article. All the welder is concerned with is the problem of overcoming distortion, or rather fracture, sometimes a very difficult problems. In repair work every job must be taken separately, on its merits, and here the ability of the individual welder to foresee his troubles, and take the necessary precautions, plays a great part, whereas I contend that, to obtain cheap and efficient production, in new work, the draughtsman is the man who should do most of the thinking, and he should produce a design, which, if properly jigged, can be welded by any operator capable of handling the blowpipe.

Prior to the war most Government departments looked upon oxy-acetylene welding as still in a somewhat experimental stage, only to be used on work of minor importance.

A number of engineers also looked upon it with considerable skepticism. The exigencies of war have wrought a miraculous conversion, and some of these reformed sceptics have recently let their zeal, for having everything welded, outrun their knowledge of "design suitable for welding."

In this matter of design, a great deal of education is still required by designer and draughtsman before welding can attain its full scope of usefulness. The vast majority of draughtsmen have not served their apprenticeship as engineers in shops where oxy-acetylene welding was used, so that they do not know the most rudimentary principles of welding, and, therefore, when setting out to design an article which is to be welded, they produce a design which makes the article unnecessarily liable to distortion, difficult to weld, expensive to produce, and infinitely less efficient as regards strength than it might easily be.

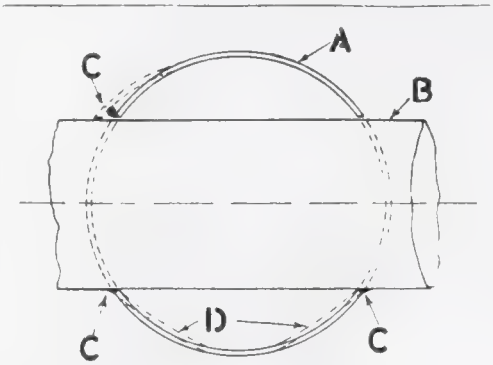


FIG. 1.

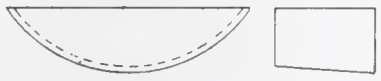


FIG. 2.

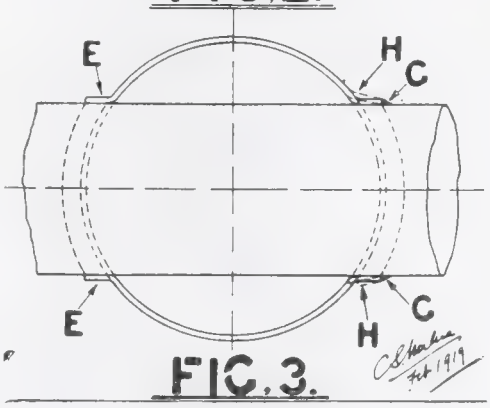


FIG. 3.

It is not my desire to try to absolve all welders from blame in the matter of failures in welded work, but in the manufacture of welded articles, in any ordinary commercial way, it is unfair to the welder to design an article which will require 100 per cent. efficiency at the weld, in order that it may have a reasonable chance of successfully withstanding the stresses which will be put upon it in prolonged use.

It is also unfair to produce a design which, in the very nature of things, must distort badly in the process of manufacture and then slang the welder for turning out an article which looks like nothing but a piece of scrap iron.

There is nothing so disheartening to the welder, or so likely to make him careless in the production of his work, as the feeling that, however much care he may exercise, he cannot possibly produce a really sound or nice looking job, because the design is such that distortion must take place.

Much can be done by jigs, but a jig which holds the article to shape at the expense of the strength of the weld is only meeting the trouble half-way, and producing an article, which, even if sound when leaving the shop, is likely to give way after a short life, owing to internal strains.

The function of the jig should be to hold the parts in the proper position for welding and at the same time to allow expansion and contraction to take place. It should not hold the parts in position by sheer force.

In repetition work I am convinced that money spent on jigs is money well spent,

and the design of simple and efficient jigs, in order to produce accurate work, often affords food for much thought, and is worthy of more attention than is usually given to the subject.

It is interesting to note, and augurs well for the future of the welding industry, that this association is not the only place where the merits of welding are being discussed.

Since our last meeting, and since I wrote the foregoing remarks, no less than four papers dealing with welding have been read before the Institute of Mechanical Engineers, three dealing exclusively with the oxy-acetylene system and the fourth with electric welding, the last by Mr. Thomas Heaton, of the Uxbridge Barrel Co., who probably has as wide a knowledge of the application of all modern methods of welding as any man in the country.

Two quotations are, I think, very apposite, one showing that, even when discussing electric welding, the large sphere of usefulness of the oxy-acetylene process, in which we are specially interested, has to be recognized. He says: "The author holds no brief for any given system of welding, and in confining this paper to electric welding he does not intend to imply that gas welding produces inferior welds. Indeed, he is of the opinion that each known system of welding has its proper sphere, and that probably any given method may be best in its respectively most suitable application. The author uses oxy-acetylene welding, and has done so for many years before the war with satisfactory results."

Again, when discussing one of the arc welding systems, he says, "The work, however, must be designed to suit the process, and the process regulated to suit the work in order to be successful. Distortion due to the heat, or the effect of contraction, must be allowed for, especially on flat surfaces, and anyone requiring welded joints would do well to consult the welding expert before definitely deciding on the details of his design."

This entirely confirms my own views, but I have frequently heard the statement made that with arc welding no allowance need be made for contraction and distortion, so I am very glad to see this statement made by one who has employed electric welding for about twenty-five years.

The spheres of usefulness for oxy-acetylene welding are, I consider, larger than those of other methods, and can be increased and perfected if careful attention is paid to correct design, in order to overcome distortion.

In dealing with light sheet or plate welding, it is not possible to overcome distortion by heating the whole job during welding. This cure would probably be worse than the disease. It is, therefore, necessary to look to other methods.

In the early days of oxy-acetylene welding, owing to the distortion difficulty, even makers of oxy-acetylene welding apparatus, who were out to boom this process, continued to produce their generators with riveted seams. I well remember one of my own difficulties with the first generator which I produced welded throughout, and which will serve to illustrate my point as regards "design to overcome distortion."

Fig. 1 is a tube passing through a larger tube. The holes in plate "A" were cut about ⅛ inch larger than the tube, "B", which was to pass through in order that it might be easy to get it into place. The weld was made as shown at "C", with the almost inevitable result that on cooling, after welding, the contraction put a buckle in plate "A", as indicated by the dotted line "D". This was partly caused by the fact that "A", when heated, expanded outwards, and, instead of being welded in its true position at "C", was really welded on as shown at dotted line "C".

Now had I been sending this design out broadcast, ordering thousands off, I should have been in a fair way to causing brain fever among those dealing with the job.

The same example will serve to illustrate my point regarding the unfairness of expecting 100 per cent. efficiency in the weld.

The makers would, in all probability, have said we must make a jig, something like Fig. 2, to wedge in and stop this buckling, with the result that the weld would be put in severe tension while cooling. The probable outcome would be that a number of the articles under test would show porosity in the weld, or cracks in or just alongside, the weld. The design is, therefore, undoubtedly effective and must be modified if good work is to be produced.

After various trials the design shown in Fig. 3 was adopted. Plate "A" was flanged, as shown at "E", and the weld made at "G". Dotted line "H" shows how the contraction after welding is taken up. This overcomes the difficulty of buckling and so entirely eliminates the strain that no buckling takes place, and jigs are not required. It is, therefore, I consider, a sound design.

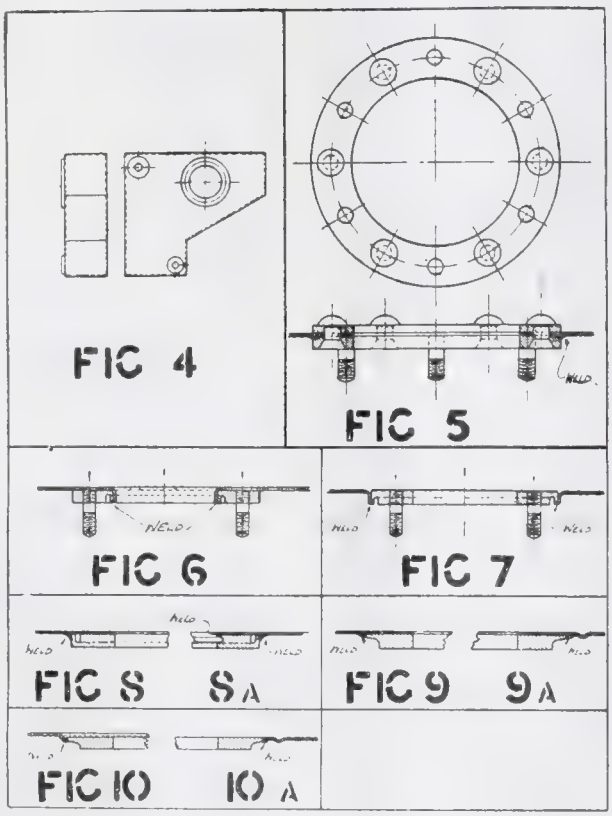
Fig. 4 is an instance of a type of design one frequently meets, a tank of ⅛ inch plate with flat sides having several pads for pipe connections, hand holes, etc. In this case it was specified that these pads were to be riveted and welded on. The weld was indicated as in Fig. 5. Now my objections to this are:

1. That I consider it bad practice to weld and rivet the same joint. If riveting will make a sound joint why weld? On the other hand, if it is necessary to weld to obtain a tight joint, why put in rivets, which will, in all probability, leak sooner or later?

2. I defy any welder to make such a weld as that shown in Fig. 5, because the penetration under the flange is shown about ⅝ inch deep, and the width of the "V" at the top, 3-16 inch.

3. The design of the flange is quite unsuitable for welding to a flat surface and must be greatly modified if successful work is to be obtained.

The weld could, in my opinion, only be made at all by employing a second blowpipe of large size to heat the thick flange while one man did the welding; otherwise the ⅛ inch plate would be burnt



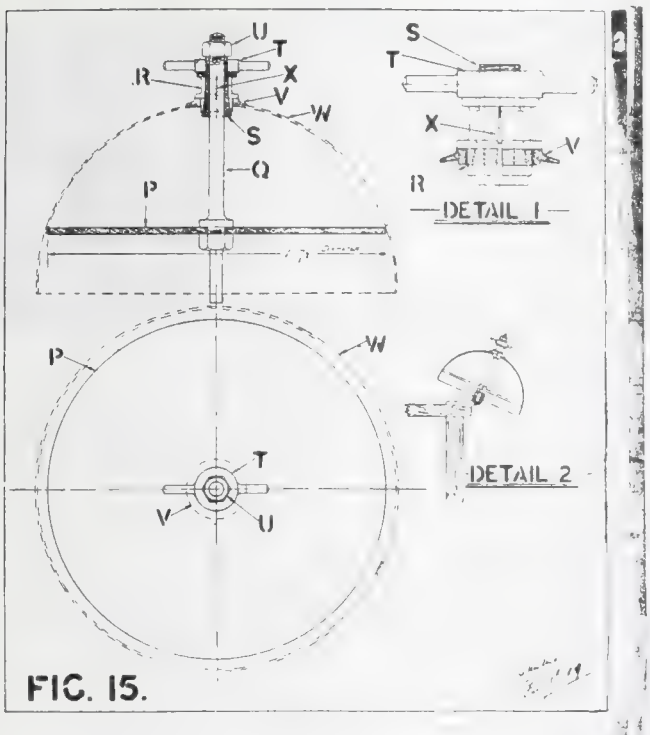


FIG. 15.

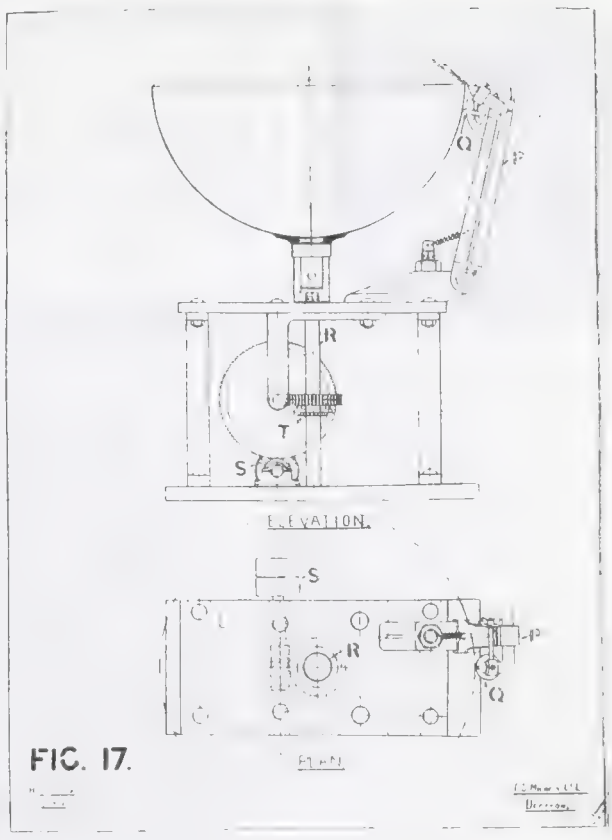


FIG. 17.

before the thick flange became hot. In any case the result would be an enormous strain on the weld, and the flat side of the tank would be distorted, so as to look like nothing on earth. This would not be due to any fault of the welder.

Several better methods, which might have been substituted, are shown in Figs. 6, 7, 8, 9 and 10. I am sure one of these could have been used, and would have been quite suitable, for the purposes for which the tank was required.

It may be urged that by riveting the plate between two rings, as in Fig. 5, greater strength is obtained than by the welding only, but I contend that the weld on the outside of the heavy flange would put such internal strains on the plate that if fracture were to occur it would be at this point, so that ring rivets would all come away together.

By flanging the plate and grooving the ring, as shown in Fig. 6, the edges to be welded are of equal thickness and a good weld can be easily made. No distortion of the thin plate takes place and no stresses are set up by welding. The studs can be taken right through the ring without fear of leakage. It has, however, the disadvantage that if a faulty weld be made it is almost impossible under test to locate the position of the leak. Fig. 7 overcomes this last objection and is stronger still, owing to the greater area of the weld, but there is danger of leaking at the studs if these are taken right through the ring.

By grooving the outside edge of the flange, as shown in Fig. 8, a weld of similar appearance to Fig. 5 is obtained while the stresses in the flat plate are to some extent reduced. By also grooving the inner edge, as shown in Fig. 8a, a seal is obtained if studs are taken through the ring.

By thinning the edge of the flange, as shown in Fig. 9, the welding is simplified, but will leave considerable stresses in the weld and surrounding plate. If, however, a corrugation can be stamped in the plate round the flange, as shown in Fig. 9a, it relieves the stresses and makes quite a sound method, and it can be combined with an inside weld, as in Fig. 8a, if desired.

For some purposes the methods shown in Figs. 10 and 10a are preferable. The radius (Fig. 10) or corrugation (Fig. 10a) relieve the cooling stresses, but careful jigging is required to keep the edge of the thin plate from buckling in or out during the actual welding.

The type of flange shown in Fig. 9, is very suitable for welding to spherical work or dished ends of vessels, as in this case the spherical end gives to the contraction by flattening.

I recently had to weld on to hemispheres a large number of screwed bosses. The method of welding is again as shown in Fig. 9. The difficulty experienced in this case was that the thread which had to pass fine limit gauges, distorted and required retapping. The heat slightly scaled the surface of the top threads and the life of the taps cutting this scaly surface was short.

Fig. 15 shows the jig used. In this job, I may mention, it was also essential that the thread should be kept concentric with the axis of the hemisphere. This makes this jig more complicated than would be required for merely preventing distortion of the thread.

The screwed boss "V" had to be welded to hemisphere "W." "P" is a circular plate with a pillar "Q" at the centre. "R" is a screwed bush bored taper inside and split, as shown at "X", so that it can be expanded. "S" is a tapered plug to fit "R" and bored a sliding fit to pin "Q." "T" is a fly-nut for drawing up the plug "S" in bush "R." "U" is a nut for holding the whole on to pin "Q." The hemisphere "W" is dropped over the pin "Q" and finds its own bearing on plate "P." The boss "V" is screwed on to the expanding bush "R" and this is then expanded by inserting plug "S" and tightening up nut "T," as shown in Detail 1. Several sets of these parts (Detail 1) are provided to each set of parts "P" and "Q."

The whole of Detail 1 is dropped on pin "Q" which ensures the thread being true with the axis of the sphere; nut "U" is tightened down lightly to keep the whole in position during welding

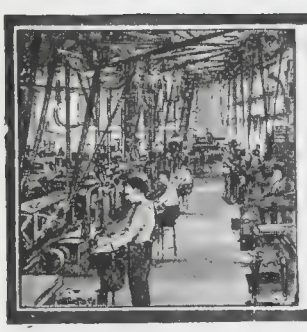
After welding, by merely removing nut "U," the whole expanding device is removed bodily with the boss and hemisphere, and is left to cool while another part is put on pin "Q" for welding.

After welding, by merely removing nut "U," the whole expanding device is removed bodily with the boss and hemisphere, and is left to cool while another part is put on pin "Q" for welding.

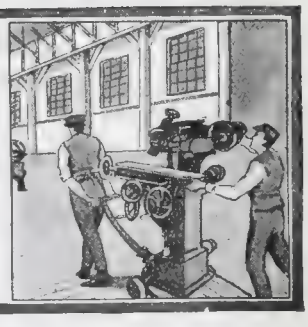
The lower extension of "Q" fits in a socket on the welding bench, as shown in Detail 2, which holds the work at a convenient angle for the welder, and makes the whole easy to swing round as welding proceeds. This is very useful, as, in the case referred to, the jig and job weighed something well over one cwt.

It was found that, if the expanding bush is left in position till the work is cold, the thread is prevented from distorting and will pass fine limit gauges after welding.

(To be continued)



DEVELOPMENTS IN SHOP EQUIPMENT



INDEPENDENT-FEED RAIL DRILL

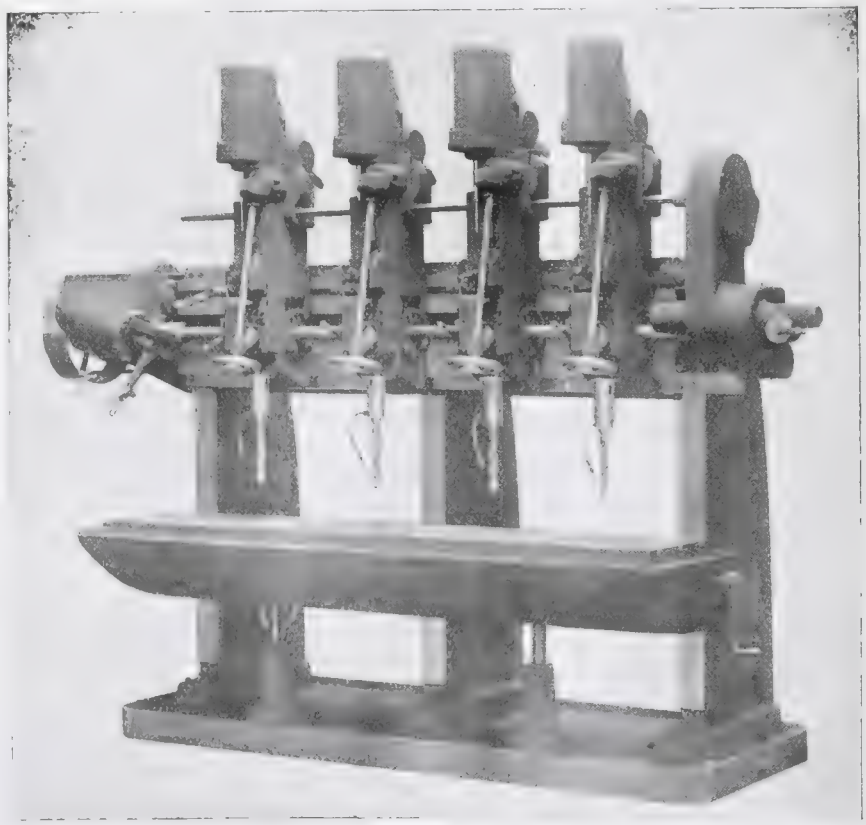
THE independent-feed rail drill, with independent heads, as shown in the illustration, is a heavy service production tool, and, though especially intended for use in locomotive and railway shops, gas engine and automobile factories, it will also serve efficiently in all kinds of general machine shops where the work includes heavy gang drilling or heavy jigged drilling. When used on jigged work, the compactness of this drill enables one operator to keep a greater number of spindles—either singly or in groups—continually in operation, and, as a result, the operator is kept constantly reloading the jigs, while a group of drills is kept constantly producing. Only the most modern methods of machine tool practice are incorporated in the design and construction of this machine. The speed mechanism, feed mechanism, and each spindle head are of unit construction, and each unit is readily accessible without disturbing mechanism other than that contained in itself.

The speed mechanism is attached to the upper end of the upright at the left end of the frame. It consists of two cones of hardened steel gears, back gears, and a hardened roll-in gear. There are three gears on each of the two cones, which provide three sets of gears of a different ratio, and these three sets of gears, when used in conjunction with the back gears, allow six speed changes, which are selected by rolling the roll-in gear into mesh with the various sets of gears on the cones. The shafts in the speed box rotate in Hyatt roller bearings, and the drive shaft, which transmits the power from the speed mechanism to the spindles, rotates in combined radial and thrust ball bearings. Power is applied to the speed box through a constant speed pulley, and transmitted through a Johnson friction clutch, which is used to select the backgear.

The feed mechanism is tightly encased, and is fastened to the upper end of the upright at the extreme right end of the frame. The feed changes are obtained through two cones of gears which are driven by the spindle drive shaft. Each of the two cones is fitted with three gears of a different ratio, which allows three changes of feed for each spindle speed. The feed changes are affected by a slip key method, which is operated by an indexed hand lever. The feed is transmitted from the two cones of gears to the feed shaft through mitre gears and a worm and worm gear, with end thrusts taken by high grade ball bearings. A hand wheel is also provided for quickly advancing or returning each spindle.

The spindle heads are gibbed to a heavy cross-rail by a dovetail method. Each head is a self-contained unit, and is adjustable longitudinally along the rail by means of a crank handle which operates a rack and pinion mechanism. The spindles are made of a high carbon forged steel, and are driven by spiral gears with two keys extending from the gear through the sleeve and into ways in the spindle. The end thrust on these keys and spiral gear is taken by a large ball bearing, while the spindle thrust is taken by S.K.F. ball bearings. This smooth and powerful drive is located at the lower end of the head, which reduces torque in the spindle to a minimum. Each spindle is counterbalanced, and can be driven and fed independently of the others. The levers used to apply the feed and drive to each spindle are interlocking so that the power feed cannot be engaged when the spindle is not being driven. Adjustable stops are provided to automatically disengage the feed when the holes have been drilled to a given depth.

The table is a substantial box type casting which is adjusted vertically by means of a crank handle which actuates two jack screws through a worm and worm gear mechanism. These jack screws support the table and maintain its original true alignment by receiving the thrust of the cutting tools on a direct centre line with the spindles. A cored section of the tables serves as a reservoir for the cutting compound, and the table casting is shaped on all four sides so as to form a trough in which the cutting compound flows back to the reservoir. The pump, which forces the cutting compound to the work, is fastened to the upright at the left of the frame and is driven directly from the countershaft.



INDEPENDENT FEED-RAIL DRILL.

The oiling method, which consists of a force feed, gravity flow and splash system combined, is made possible by the all-enclosed unit construction. The speed mechanism, feed mechanism, and each of the spindle heads are provided with independent and self-contained oiling systems which eliminate the human factor in the care of this machine, insure positive lubrication and economical maintenance. The contents of each unit is partially submerged in a bath of oil, while the bearings are lubricated by a force feed through individual leads which carry a sufficient flow of oil to flush all enclosed parts on its return to the reservoir.

This machine described is manufactured by the Defiance Machine Works, Defiance, Ohio, and following are its principal specifications:

Specifications

Capacity in solid steel, 2 in.; maximum distance nose of spindle to top of table, 32 in.; centre of spindle to face of column, 12.2615 in.; minimum centre to centre of spindles, 8 in.; maximum centre to centre outside spindles, 78 in.; length of power feed, 12 in.; table, working surface, 20x98 in.; table, vertical adjustment, 12 in.; speed changes, six, 25, 38, 58, 80, 122, 186 r.p.m.; feed changes, 3, .006 in., .009 in., .014 in.; diameter of spindle nose, 3 in.; diameter at driving point, 3 in.; diameter of spindle sleeve, 4 in.; morse taper in spindle, No. 5; drive pulley, face and diameter, 20 in. x 5¼ in.; drive pulley, speed, 350 r.p.m.

DAVENPORT NO. 2-B PLAIN MILLING MACHINE

The Davenport Manufacturing Co., of Meadville, Pa., has recently placed on the market a new type of plain milling machine, listed as No. 2-B. It is furnished with back gear drive, thus offering great efficiency under maximum load. The machine is pleasing in design, compact and rigid when in operation. The table has a surface of 38x10 inches, with a working range over its entire length and breadth. The longitudinal movement of 23 inches is automatic, and is obtained through gears and a feed screw of 4 threads per inch. Provision is made for a quick return of 1¼ inches per turn of crank. The cross movement of the table is 9 inches, and a vertical adjustment of 19 inches is provided.

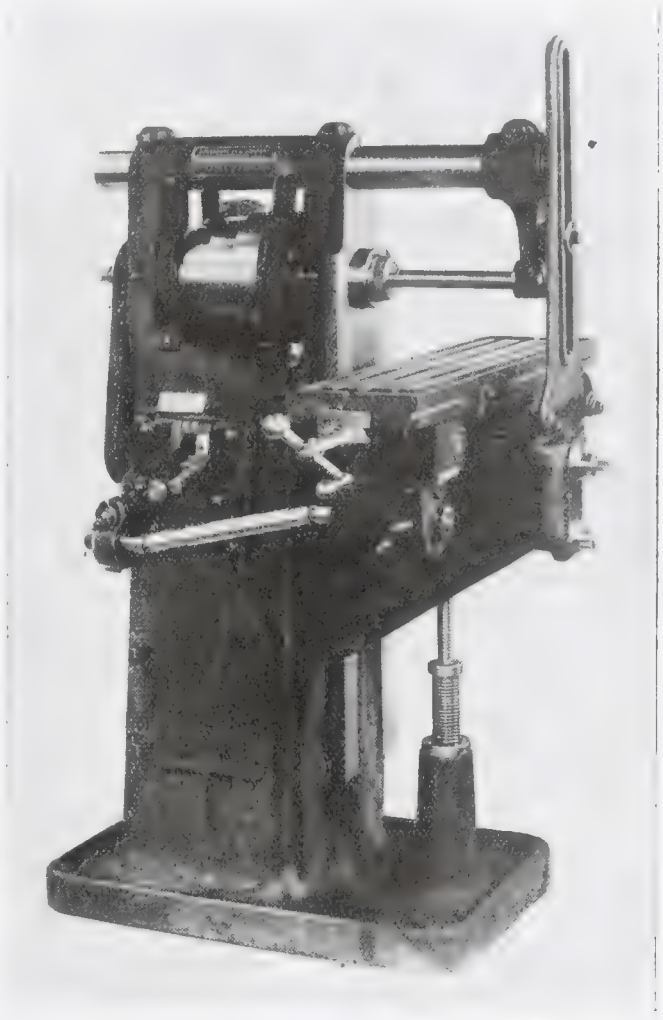
Table bearings are extra wide and the top is provided with three ⅝ in. slots.

The spindle is made of forged crucible steel and runs in phosphor bronze bearings, easily adjusted to wear without removing the spindle. The front journal is 2½ inches in diameter and 4¾ inches long. The nose of the spindle is 2¼ inches in diameter, threaded 10 threads per inch, R.H. The hole through the spindle is 11/16 inches in diameter and the front end is bored to receive a No. 10 B. and S. taper socket. Spindle thrust collars are hardened and ground, and ample lubrication is assured through large oil reservoirs located in the housings.

A three-step driving cone is used, with diameters of 7.73, 8.86 and 10 inches, adapted for 2¼ in double belt. The ratio of the back gears is 4.57 to 1. Twelve spindle speeds are provided, in geometrical progression: 20, 27, 35, 45, 59, 77, 95, 123, 160, 204, 270, and 350 revolutions per minute. Change gears are self contained and located in the bed of the machine. Twelve feed speeds are provided, ranging from .004 to .047 inch per revolution of the spindle. All feed gears are made of a special alloy steel, the drive from the spindle being obtained by means of a roller chain. All feed changes are obtained through three levers, while the reverse is made by a push rod located on the feed box. All working parts of the machine are oiled from the one main reservoir in the column. The feed tripping mechanism is of the plunger type.

The overhanging arm is made of special steel, and is 3¼ inches in diameter, its under side being 6⅜ inches from the centre of the machine spindle. The arbor is made from .70 carbon, chrome nickel steel, heat treated, and having a diameter of 1 inch, and a length of 10 inches between the shoulder and the nut. The outer end is supported in special design ball bearings. Dials on the feed screws are all adjustable, and graduated to register movements of the slides in thousandths of an inch.

The countershaft is adapted for two speeds, 123 and 270 rev. per min. Clutch pulleys are self-oiling, 10 inches diameter and 3½ inch face. Shaft is 1 9-16 inches in diameter and runs in self-oiling bearings. Vice, end braces and other accessories are also furnished. The extreme floor space occupied is about 48x74 inches, and the net weight about 1,900 lbs.



DAVENPORT PLAIN MILLING MACHINE.

RE NEW EQUIPMENT

It is our intention to make this section more interesting than ever before, and we would ask the various firms throughout the country to co-operate with us in this regard.

Immediately you have a new line or new addition to your line, send us photographs, or better still, electros or half-tones of the new departure, together with descriptive matter, after which we will do the rest.

In this way our section will prove of more value both to the reader and the manufacturer, for we will then be able to publish promptly these new lines as they come on the market.

When we receive electros or half-tones we can, of course, publish the matter more promptly than if we have to make our own cuts.

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Something Better Than a Strike

THE sympathetic strike in Winnipeg has been called off. This should not be regarded in the light of either victory or defeat for capital or labor.

It must be taken as nothing short of a challenge to both parties to set to work to build up conditions from the Winnipeg mess that will make such an event out of the question again in this country.

The manufacturer, or the employer of labor in any capacity, might as well face the conditions. These new conditions are here, and they show no signs of picking up and moving out.

The personal element—the human side of the shop business—is coming to the front. The wise employer is going out and meet that new element half way. The fool hirer of men may slam the door in its face. By so doing he is going to nurse trouble and fall into the rear end of the industrial procession.

The manufacturers in many places are catching the vision. In some cases the light is taking a fairly long time to break through.

That big wall that has been built up between the shop and the office, between the firm and the employees, has got to be battered down. Not all at once. Such an attempt would spell failure at the outset. But little by little, pulling down a brick here and a tier there—gradually putting that bogey barrier out of existence. It is a big job and a hard one, but the very fact that it is hard and big make it attractive to men who like to tackle worth-while propositions.

CANADIAN MACHINERY has discussed this matter with men who have much to do with the framing of conditions under which thousands of men work. There is a new feeling in the work. It may be a result of the war—it may be a desire to give a square deal to men who risked everything at the front—it may be on account of pressure from industrial unrest—take what reason you wish, but the bare fact remains that there is a greater realization than ever before that the man in the shop must come more than ever to the front. He must not only have his labor power for sale, but the management is coming into the market now to get the good-will of the man as well as his ability and his muscle. The firm that gets its men—their ability, strength, enthusiasm and good-will—gets the real thing in industry.

There is no reason for the men to regard this new movement with disfavor. There is nothing in it that fights their views on unionism, or interferes with their affiliation with any legitimate trades or labor organization. The men should meet it with an open mind. Don't take the prejudiced view that the company is trying "to put one over."

There has been too much bitterness during the past few months. It is not going to get the employers or employees anywhere, except in a heap of trouble. Every question has two sides, and on neither of these sides can all the right and virtue be corralled. If these two parties are not prepared at this or any other time to sit down together and talk calmly, honestly and candidly about THEIR business affairs, then the future for both is poor and black.

This is not a time to harp or gloat over the success or failure of the Winnipeg general strike. It was a nightmare and a mistake. The big thing now is not to glory in post-mortems over that event. The great task is to set determinedly to bring about conditions in this great country that will draw a straight and clean-cut line between the legitimate complaint of a worker and the machinations of the agitator who makes more money on strike than at work.

CANADIAN MACHINERY believes that RIGHT NOW is the time for these things to take root and grow. Employers who look ahead can see the new era in industry coming. The old period of master and servant, of lord and hireling has gone. Don't struggle to make yourself believe that it will return. It will not and you would not bring it back if you could.

The new industrial era is here. The wise man is going out gladly to meet it and take it into his organization.

Amateurs and Experts

THE editor of the Toronto *Telegram* was called to Ottawa a few days ago to appear before the Commission that is now investigating the high cost of living, or simply the cost of living, because it would be poor business for anyone connected with a Government to say living was too high.

The Toronto editor and the committee had a real session. It was no parlor meeting, accompanied by the tinkling of tea cups or the trickling and dripping of soup.

They all went out into the backyard, left their smocks, caps and trinkets on the steps, and set to.

Many things were said. Even the sergeant-at-arms, who is supposed to play the part that an Indian plays for a cigar store, was wheeled out to look through the knot-hole while the game was on.

When it was all over the yard was badly mussed up and the committee and the editor were all ready for a spell with the clay dab in the shade of the wood-pile.

The cost of living hadn't been brought down—not a dent made in it, but there had been one single, lonesome truth that stuck up like a sore thumb.

It was tossed in by J. R. Robinson, editor of the *Telegram*, when he said:—

> "I stated an obvious truth that a committee of amateurs cannot examine an expert."

There have been more committees at Ottawa at times than they have had rooms to put them in. When they got tired calling them committees they changed the shingle to read "commissions."

And these committees or commissions have proceeded to spade up the garden lot for facts that should be gone after with a derrick and a stump puller.

In fact, it might not be a bad idea for some of the handy men they have choring around the Ottawa House to carve a bit of a sign and nail it on the door of the investigation chamber:—

"A committee of amateurs cannot examine an expert."

The Investment Buyer

THE markets are waiting for the coming of the investment buyer. He has been out for some time, and any sign of his return would be welcome news.

The investment buyer is a fairly long way removed from the hand-to-mouth purchaser. The former sits down and figures that he can find a market for something. That something may be goods for export, may be office space or hotel accommodation. His buying represents an investment, a tieing up of money against which he will have to work for some years to come. The hand-to-mouth buyer is a different proposition. He gets in a job and he buys the material necessary to see it through. What he puts into the work can hardly be called an investment. He simply puts his money in and collects it all in a short time from the buyer of his work. The market cannot run on this man's business alone. It does not give the necessary stability. It does not produce the large orders needed to get capacity output at the mills, without which production costs cannot be brought down.

The investment buyer hesitates to come into the market. He has had a list of reasons for not doing so that are a yard long. After war conditions, price-fixing and one thing after another have been grabbed up and gazed upon as bogey men to keep him from the market.

The signing of peace has been the last big consideration. For months it has been bolstered up as the last defence behind which the should-be buyer has squatted.

Now this may be taken away from him by the few strokes of a pen.

The market needs the investment buyer. He has been out of commission for a long time, although he has been making all sorts of motions that he is about to return.

Let him come. The hand-to-mouth chap has been doing fairly well, but he has his limits. Lead in the investment buyer.

Not All Profiteers

THE investigations that have gone on at various times in Canada into the charges of profiteering have brought two parties to the front, namely, the investigator and the party investigated.

A third party should be taking a hand in the interests of the great body of Canadian manufacturers.

The word profiteer is being hitched to-day by inference and association where it does not properly belong.

There are firms that made money out of war contracts. If they made too much it is up to the Government to get it away from them.

There are other firms that would have been better off by thousands of dollars had they never seen a munitions contract.

There are concerns that made money during the war years. The Government got a goodly share of it. At the close of the war they were left with thousands of dollars' worth of stock that had nothing but scrap value the day fighting ceased. There was no come-back for them. This year they are going to have a financial funeral.

Canadian manufacturers, in their own best interests, should see to it that no commission gets a chance to tag them as a body of "profiteers."

Don't be a Tinker

DON'T be a tinker. If you are going to do anything in life, do it well.

Do one thing better than any person else can do it.

Ever see a handy-man? You know the kind. He's not particularly skilled at anything particular, but he can catch on quickly. He makes a great stop-gap in the shop—and he generally sticks right there.

Ever meet the chap who can play a few chords on the piano, and who can sing a couple of old songs to his own playing? He gets through all he knows in a few minutes, and if he has to do anything more, he's up against it. As a matter of fact, he's only a tinker. He can neither play nor sing, and yet he imagines he can do both.

You have seen the average clerk in operation in a store. No matter whether it's groceries, dry goods, boots and shoes. In a general way he can get you what you want if you have a pretty fair idea of what you want before you go in. But he will never sell you anything else. He will never size you up as you enter the store, or as he talks to you as a prospective customer for some new lines of goods that the store carries or is going to carry. He is just an average, garden variety. In fact, he's a tinker in his line of business.

You know a machinist who can draw a little. He can make a rough sketch. He cannot make an intelligent drawing that would serve for a blue print. He's just a tinker, and as far as getting himself any place, he might just as well hold up his fist and own up to the fact that he can't draw at all.

Don't be a tinker. Do something, well—much better than any person else. Then there will be a demand for your services that will shove you head and shoulders past the tinker class.

The Stopping of a Car

IN what distance can you stop your car? Perhaps you have never figured it out, but others have. Providing the brake mechanism is in good condition and the road conditions are average, or in such condition that the tires can grip, the following table is given:—

At ten miles an hour you should stop in 9.2 feet.
At 15 miles, in 20.8 feet.
At 20 miles, in 37 feet.
At 25 miles, in 58 feet.
At 30 miles, in 83.3 feet.
At 35 miles, in 104 feet.
At 40 miles, in 148 feet.
At 50 miles, in 231 feet.

TORONTO has had a street car strike for over a week. Of course, there have been some cases of inconvenience. The remarkable thing is how well people have got along without the cars. The automobile age has provided a tremendous amount of transportation. Each year now will make it increasingly hard for a street car strike in any large city to inflict the inconvenience of ten years ago on the general public.

* * *

IT COSTS more now to get your picture painted than formerly. Still that is one form of dissipation that we can side-step and still have a fairly good time.

* * *

TO HEAR some Western grain growers talk on tariffs and Eastern profits at times, one might think the Westerners were right down to a shoe-string and nose-bag of wild oats. At the Ottawa inquiry it comes out that the Grain Growers earned 23 per cent. on a large capital, paid handsome salaries and bonuses and piled up a big reserve.

* * *

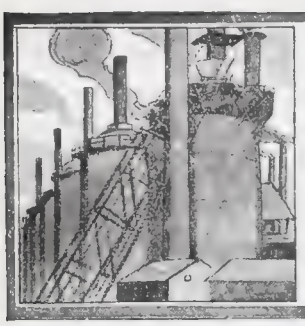
OCCASIONALLY one sees a stork in the Zoo, but there must be a stack of these things some place in the woods, for there were 1,352,792 births in United States last year.

* * *

A PENNSYLVANIA man named Hart got a quantity of maple syrup poured into his car instead of oil. And now we presume the neighbors will say, "There goes 'sweethart' for a drive!"

* * *

A CALIFORNIA man left $19,000 to his son. The only string is that the son has to earn $30,000 clear before he can get the $19,000. Chances are that by the time he piles up that sum he'll have cut enough wisdom teeth to know how to handle the smaller amount. It looks as though that fond parent knew a thing or two that the average chap never thinks about.



MARKET DEVELOPMENTS

Prices Stay Firm in Spite of Circumstances

Machine Tools Reports Say, Are Going to Move Higher in the Fall—Strike Is Giving Some of the Manufacturers a Big Problem —Greater Strength Shown in Scrap Market.

THE one surprising thing is the manner in which prices have been sustained during the months since the beginning of the year. In some ways it would seem that there has been nothing but monkey wrenches thrown into the industrial wheel, but the fundamental conditions remain firm.

Advices from the big machine tool centres hinted some weeks ago at a lessening of prices and greater discounts, but this is not borne out by reports that are coming through now, as indications are for higher prices for the better machines. Deliveries are only fair, indicating that in a good many cases the demand for machines keeps well ahead of the ability of the shous to turn them out.

The same can be said of the price of steel. Rumors were plentiful that the withdrawal of the fixed price would see the price crack. It did not happen then, and it has not happened since although the price control and support has been withdrawn for some time.

As mentioned before in this report, the end of the strike in this district is much desired just now. There are serious problems facing some of the manufacturers. It may be that shops will close down for the rest of the year, if not for the winter as well, as the season has in some cases almost closed when the product could be sold to advantage. Large investments, running into hundreds of thousands, are tied up all the way from the molding shop to the shipping department.

Buying is not in large quantities in the warehouse trade, although some of the dealers are quite certain in their statements that they have no complaints about the amount of business moving. They look forward to better days, reckoning that in many instances these must come irrespective of circumstances. They know there are large buildings that must be gone on with, and the time when these orders will be ripe for conversion is drawing close.

Machine tools still come into competition with the large amount of war-ship equipment remaining in this country. The bargain hunter is present in the machine shop business just as truly as elsewhere, and the "price" has a lot to do with the placing of business.

THE STEEL MARKET WAITS FOR THE RETURN OF THE INVESTMENT BUYER

Special to CANADIAN MACHINERY.

PITTSBURGH, Pa., July 3.—The signing of the peace treaty is expected to bring out a great deal of additional demand for steel. It is pointed out that a great many construction projects, involving the consumption of steel, have undoubtedly been held back, as a matter of general policy, to await the actual signing of peace. It was the common appraisal of the future of business, before the armistice was signed, that business of all descriptions would be stifled to a greater or less extent during the interim period between the cessation of hostilities and agreement upon peace terms.

The demand for steel in the past few months, when analyzed in detail, has shown clearly the distinction between two classes of orders, those that involved ordinary everyday consumption of steel and those that involved investments, such as can be made or postponed according to the judgment or whim of the investor. For example, there has been an excellent demand upon the pipe mills for "oil country goods" because oil is high priced and there is a continuous demand for it, but there have been practically no projects involving the laying of long oil lines, such as are regarded as of an investment character. Again, there has been an excellent demand for nails, which are used in common everyday life, while there has been little demand for structural shapes, which are used for building factories, skyscrapers, and bridges. A comparison like this might be carried to great length. The investment buyer of steel is expected now to be a much greater factor in the market than in the past few months.

Some Demand Increased

A further improvement is reported in the demand for sheets. Having operated at about 60 per cent. of capacity in May, the sheet mills operated last week at fully 75 per cent. This week there is some idleness on account of the holidays, the time being propitious for making repairs. One plant, the Deforest, at Niles, recently acquired by the Republic Iron & Steel Company, is down for the month, installing an electric drive. The steam plant is abandoned and current will be purchased from a public service corporation, although eventually the company may carry current from its main plant in Youngstown to the newly acquired plant.

There has been improvement in demand for butt weld pipe, which is now running at a rate of about 75 per cent. of capacity, while lap weld departments of the pipe mills, chiefly by reason of the heavy demand for oil country goods, are not only operating at capacity, but are filled quite solidly with orders for a couple of months to come.

In merchant bars there is improved demand, though the total is still far below mill capacity. Plates continue to present an extremely sluggish appearance, although perhaps the appearance would not be so bad if there had not been such a large increase in productive capacity in the past two years.

In addition to the 200,000 tons of rails recently purchased, the Railroad Administration will probably buy 300,000 tons, which will round out its requirements for the year.

Prices Firmer

Price cutting has not disappeared from the finished steel market, but there is less of it, apparently, than 30 days ago. The important feature, however, is that there has been price cutting for so long a time without its pulling down the general market level. The market has displayed an inherent strength that was hardly expected of it. Earlier in the year the philosophy of the mills was, in substance: "Let us hang together, so that we do not hang separately." Price cutting, it was then thought, would cause the bottom to drop out of the market. Accordingly, it was very unpopular to cut prices, but of late there have been several lines of finished steel product in which a mill could have felt free to cut prices, if it desired, because it had so many examples to follow. In sheets, for instance, while the leading interest has adhered strictly to regular prices at all times, there was a time when probably 25 per cent. of the tonnage booked by independents was at cut prices. The proportion is now less. The Inland Steel Company, for instance, has withdrawn from the market entirely, being comfortably filled with orders. In pipe the irregularities recently far from uncommon have practically disappeared.

Pig Iron Steadier

Pickands, Mather & Company and M. A. Hanna & Company are each reported to have sold fully 100,000 tons of pig iron, chiefly foundry grades, in a period of 30 days. Other producers have also done well, and the merchant furnaces now operating, with perhaps an occasional exception, are now comfortably filled with business for the third quarter, with some tonnage booked for fourth quarter. As a result there is little disposition to shade regular prices, which are those of March 21, except where it has been necessary for individual districts to develop different levels in order to place their markets in normal trade relation with prices in other districts.

While the market has thus improved materially, furnacemen hardly expect any advance in prices to occur in the near future. They recognize that with so many furnaces out of blast the market would experience difficulty in advancing. The furnaces that went out of blast did so not because they wanted to be out of blast, of course, but because they wanted the situation to be liquidated. They did not want to take chances in trying to stay in blast by cutting prices, as there was no telling where prices would go in such case. Now, however, they are eager to get in blast again, and many of them would probably decide to blow in if they saw an opportunity to build up some backlog business for the start, even perhaps at the expense of cutting existing prices slightly. Thus while few are disposed to predict positively that pig iron will advance this year, there are many who express conviction that next year it will be above present levels.

Mill Operations

Steel mill operations may be estimated at a rate of 65 per cent. of capacity, representing a rate of ingot production of about 32,000,000 gross tons a year, capacity being about 49,000,000 tons. This compares with an average rate of 54 per cent. during May, while about the middle of that month the rate had probably dropped to about 50 per cent. Thus there has been a very substantial recovery. The present rate is approximately equal to the average rate in April.

Wage Scale Settlements

After making extremely strong demands in connection with the sheet and tin plate wage scales for the twelvemonth beginning July 1, the Amalgamated Association has accepted some slight advances for some members of the crews, whereby the total of sheet mill wages is advanced 3.6 per cent. and the total of tin mill wages about 2.6 per cent. The settlement refers only to the labor at the hot mills. Less than half the mills are organized, but the non-union mills, with few exceptions, pay at least union rates, and some make a practice of paying just a shade more.

POINTS IN WEEK'S MARKETING NOTES

Scrap metal markets are much stronger this week. Large dealers report that Canadian foundries and steel mills are buying, which is the first time this has been reported for some weeks. Although prices have not been marked up in several cases the values are better than the price list indicates in Toronto. Montreal has advanced prices quite materially.

—

Cancellation privileges that went with some good sized orders for tubes were not taken advantage of, and the shipments were taken on. This may mean some news in regard to the settlement of the metal trades strike.

—

Machine-tool dealers report that they still come into conflict with the war shop machinery, of which there is considerable in the country yet. However, they are willing to admit that this is not nearly so serious as appeared likely at the close of the war.

—

New York reports indicate that prices on machine tools may be even higher by the fall.

—

Pittsburgh despatches state that the improvement in the production of the steel at the mills there is being sustained.

—

Strikes in the West have made matters pretty much tangled with the firms that have their head offices in the East. There had been no communication for some days and no express. Many of the managers and staff were away from business entirely, acting under instructions from the Committee of One Thousand.

—

Metals are stronger, copper being marked up again, with indications that third and fourth quarter deliveries may reach still better figures.

STRIKE PUTS END TO SALES THIS YEAR

One Firm Has Quite a Proposition as to Whether to Close for the Season

TORONTO.—The holiday coming in the middle of the week has a tendency to make it a short one for dealers, as many of their prospects take the week-end and the section of the week lasting over the holiday as well. Small sales are the order of the day. Not much business is coming out of the Toronto field at present, the strike, which has now lasted going on two months, being responsible for much of this. Those who were figuring on equipment are not going ahead until things become settled, and those who purchased equipment are rather tied up for want of production from it.

Big Decision to Make

One of the firms now affected by the strike is seriously considering what to do for the future. They make a line of goods that has a ready sale during the summer and fall months in the rural communities. When the war ended, they put over $200,000 in new equipment, and got in shape for going ahead, expecting to get production at the latest by the middle of June. The strike has tied them up, their orders have largely been allowed to slide, or they have farmed them out elsewhere, and their sales staff has been left with much less to do, adding to the overhead of the firm. For almost two months now over $200,000 worth of equipment has been tied up there all the way from the molding shop to the shipping room. The firm has not decided whether to shut down entirely for the season, as production later on now in the fall will be of no use to them for this year's selling.

Meet Competition Here

Some of the dealers claim that they are still running into the old war shop material when trying to dispose of new equipment. While this may be so, it has not proven to be the menace to the trade that was feared some time ago. The railroad shops, for instance, were

out with a big list some weeks ago, a large amount of which went direct to Bertram's at Dundas and the C.M.C. at Galt. The list was then sent to the old Ross Rifle plant at Quebec, which the Government owns, to see what material would be available there. Dealers had been figuring on getting a nice slice of that business, but they are not complaining, and are ready to admit that it is good policy for the Government to go ahead and use the material they have on hand.

The strike in the West has had quite a marked effect on some businesses here with branches there. In one case the manager of a big machine-tool house was out for weeks in charge of one of the fire stations, while the assistant manager was in the barracks training as a soldier under the Committee of One Thousand. No mail or express go through, and it will be some time before the affairs of that branch can be straightened out.

But no one comes along to say that business is poor. Willing to admit that it might be better, dealers are also unwilling to state that they have a serious kick to make. In fact the manager of one of the houses in Toronto stated to CANADIAN MACHINERY this week that their business was keeping up remarkably well month after month, and there had been nothing so far that looked like a slump.

One Cheerful Chap

CANADIAN MACHINERY ran into one chap who was all optimistic this week. He is in the scrap metal business in a big way. He was not at the point where his optimism led him to mark up prices, but he was quite willing to admit that it would come very soon, in fact values are a little better right now than the price list indicates, but it is not good to shove up the list for a few days and then lower again.

The scrap yards are selling a fair amount of material right in Canada now to the foundries and mills. This is the first week that any movement of this sort has developed to any extent. There is a better feeling in the market, and that hesitation that was so manifest for some time is largely passing away. There is a certain amount of shipping directed to United States points. More material is being offered for sale than for some weeks past. Dealers are willing to part more freely with some of their material, and transportation and other companies are sending fair offerings to the market. It all points to better days for the scrap market. They are well nigh due, as the second hand metal market has been a poor one nearly all the way through since the signing of the armistice.

Buying in Small Lots

Prices remain firm in all lines of steel. This is the general statement that is given out, but the fact remains that the firmness of the prices might not be quite so pronounced were a nice, good-sized block of business to show up on the horizon. There has not been enough big buying for some time to really tempt the market figures down, and there is a general feeling that if much buying starts now the price tendency would be in the other direction.

The railroads are still buying a lot of material, and some of the shipyards are coming into the market, too. These firms generally buy pretty well in advance, so it seems likely that it is for business just booked that the inquiries are now coming in. There are some orders in Toronto shops that were on the anxious seat for some days recently. There was a cancellation clause attached —tubes in one item referred to—and it did look as though it would be asked for. However, the firm has taken the goods all in and is in the market for more. It may mean that they intend to operate again shortly. Whether any solution of the strike is in sight that we have not heard about, is not known, but the fact that they are in the market in a fairly large way is a bright spot not to be overlooked.

Metals Are in Demand

There is good demand for metals this week. Some of the largest dealers claim that although there has been some loss of trade due to strike conditions, business is a long way from being seriously affected. Buying is very general in many lines and firms that have much call for copper later on in the year are buying quite freely now in view of prices that seem to point upward for the third and fourth quarter. There is no doubt, either, that the recent tariff is having some change in the price of copper.

Spelter is also stronger, and a little of its new strength may also be traced to tariff conditions and changes. It is selling now at $8.50 per pound.

"PEACE TIME" TRADE IN MONTREAL SHOULD MEAN BETTER BUSINESS NOW

Special to CANADIAN MACHINERY.

MONTREAL, July 3.—The signing of peace marks the close of an epoch of the world's history that many of us are glad to see come to an end. The future may not be all roses, but predictions are that a period of industrial activity will follow the depression that has been evident during the first six months of this year. It is generally conceded that the delay in the concluding of peace has been instrumental in the reluctant attitude of many manufacturers in starting on a campaign of reconstruction activity. This condition may now be replaced by keener interest on the part of business men and the way opened for establishing a reliable basis for future enterprise. This step may be aided considerably by the better tone in the strike situation, a factor that will, no doubt, assist materially in quickly adjusting the business and working relations between labor and capital. Steel is devoid of active interest and dealers here report a very quiet in fair volume, but general steel commodities are quiet.

"The high cost of living," stated one dealer, "is felt in more directions than those directly connected with home surroundings. This condition is naturally reflected in industry and conservative methods are the rule where enterprise is contemplated. Many circumstances are combined to restrict the reconstruction activity and time alone is the one factor that will solve the final adjustment of present unrest and unsettlement." Local strikes have been felt slightly, but have had little effect on current demand.

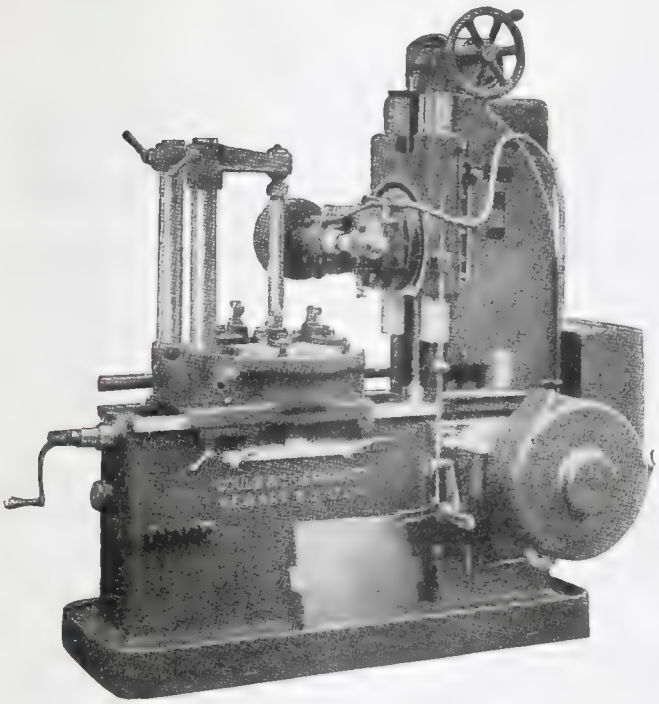
The belief still hovers about that peace settlement will act as a turning point, and that from now on business will show a steady return to normal. Price quotations in all lines are quite firm, and even with a strong undertone.

Steady Strength in Metals

Whether the signing of peace is responsible for the better tone of the metal market, or that the time is opportune for a better buying movement is a question of the hour, but the fact remains that dealers are disposing of more metal now than they have done for some time past. This is particularly noted in coppers and spelter, the sales of these metals having registered material increases. Copper is now quoted at 22 cents for lake and 21 cents for electro and castings. The tin situation is gradually adjusting itself, as the market is now virtually free from Government restrictions, as far as Canada is concerned. The supplies of tin are more plentiful and present requirements are normal, assuring ample metal for all possible early demand. Dealers here are quoting 55 cents for tin, a decline of one cent on the week. The stronger spelter market is responsible for an advance of ¾ cent in the quotation, this week's price being 9¼ cents per lb. Lead is also stronger on steady demand, the price quoted being 7¼ cents per lb. Antimony is firm on light demand. Aluminum is weaker with fewer sales; the local quotation is 36 cents per lb., a drop of 2 cents on the week.

Scrap Retaining Its Strength

Although the demand has shown no marked increase over the past few weeks, the strength of the old metal situation is well maintained and quotations are of a very firm character. The foundries are not buying as heavily as usual and only for immediate needs. The feeling, however, still exists that better times are in prospect before the summer is over. This is the impression of quite a number, and the reports from different quarters seem to verify this belief. The general movement of scrap is comparatively light, but what little enquiry is reported would imply a better buying of scrap might develop in a few weeks. Firmness is a feature as to prices and



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what few changes are effective show a slight advance. Machine composition is quoted ¼ cent higher at 12¾ cents per lb. Medium brass is quoted at 7 cents, an advance of one cent over last week. Scrap zinc is selling better and the price asked is 5½ cents, ½ cent higher than a week ago.

NEW YORK MARKET PREDICTING HIGHER PRICES FOR MACHINE TOOLS

Special to CANADIAN MACHINERY.

NEW YORK, July 3.—Some manufacturers of machine tools predict that selling prices during the latter half of the year will be higher than those which now prevail. Labor costs show a tendency to advance rather than decline. Quite a few machine-tool builders have already received notice from foundries of higher prices for castings due to the demands of iron molders for higher wages and a shorter working day. Among machine-shop workers also there is an agitation for a 44-hour week without a reduction in pay, and if this becomes generally operative, higher labor costs will naturally follow. All indications at all events point to the probability that prices will not go lower, this year at least. Many users of machine tools who feel that they cannot afford to pay the high prices demanded for new tools are looking very carefully into the second-hand machinery market. A fair proportion of the tools from war plants are in pretty good condition, and the prices on this equipment are considerably lower than on corresponding new tools. The competition of second-hand tools is becoming a more and more serious factor from the standpoint of the machine-tool builder.

Conditions in the New York market continue only fair. There is no improvement in business, a fair amount of small orders coming in, but there are no large inquiries. While there is some disappointment that the readjustment from a war to a peace basis has been proceeding so slowly, the first half of the year has produced for many machine-tool builders a very satisfactory amount of business.

The John Wood Mfg. Co., Conshohocken, Pa., manufacturer of tanks and boilers, has acquired a manufacturing plant in Toronto and will purchase equipment there and in Philadelphia for the Canadian branch. Among the company's requirements are plate-working and pipe machines.

BUYING BETTER AND PRICES ARE SHOWING A TENDENCY UPWARD

SMALL advances in price are pretty general in the scrap market. These are not all based on actual trading, but in some cases reflect the feeling of optimism among the dealers. Following are the reports from U. S. points:

Chicago.—Feeling that there will be a buying movement by mills and foundries in the near future, dealers are bidding up prices on Government scrap offering. Advances have amounted to as much as $2 per ton. The Government has sold 17,000 gross tons of ingots at an average price of $19.

Philadelphia.—Dealers are showing no anxiety to sell heavy melting steel at present prices. They prefer to pile it in their yards in anticipation of an advance. Small sales of car wheels, low phosphorus and turnings have been made at prices a little higher than those on previous sales.

Birmingham.—Cast scrap is being sold freely, but heavy melting steel is being held by dealers for a better market. The tone is generally good. Steel rails are quoted from $12 to $14; cast iron borings from $6.50 to $7.50; steel axles from $18 to $20.

Buffalo.—A fair amount of business is being done and a large number of enquiries are out. Dealers' demands are, however, more than the consumers are willing to pay in many instances, especially in heavy melting steel. Dealers are holding for $16.50 to $17, and expect a $20 price before long.

New York.—Contrary to prevailing conditions in other countries, the most activity here is in heavy melting steel, borings and turnings and iron pipe. Prices have advanced on an average 75 cents during the past week. Chinese interests recently purchased 3,000 tons of steel scrap.

St. Louis.—Although various railroads offered last week an aggregate of 7,000 tons, the market continues to hold its strength. This is chiefly due to trading among the dealers themselves, which continues, though little business is being done between consumers and dealers. Prices are therefore nominal.

Cincinnati.—The feeling of the dealers is reflected in prices, which have been advanced on several grades. Rerolling steel rails have shown the greatest strength in this direction, being quoted $17 to $18 per gross ton dealers' yard. Other grades have gone up 50 cents to $1.50 per ton.

Cleveland.—Although dealers have large stocks, they are disposed to hold them for better prices. Heavy melting steel has sold as high as $18.50, one consumer taking 1,500 tons at that price. There has been a general advance in all other grades, No. 1 cast being quoted $23 to $24.

BUYING BETTER

Reports Indicate That Business is Now On a Much Better Footing

CONTINUED activity in the centres where the buying movement originated, and an improving interest in some of the quieter spots, are the market features this week. Following are reports from various centres:

Chicago.—Genuine enquiries, followed by prompt buying of round tonnages, describe the conditions here. Quantities closed run from 500 to 4,000 tons. Good enquiries for malleable are on the market. Stocks held on furnace banks are fast disappearing, and talk of blowing in idle stacks is heard.

Philadelphia.—Sales of foundry iron have been good during the week. Prices firm, though showing weakness in spots. While nothing that could be construed as a general buying movement has developed, a satisfactory increase has been shown in sales.

Birmingham.—The last two or three weeks have been responsible for business reaching nearly 150,000 tons. Yard stocks are showing signs of depletion, and the total holdings in this line are much below 100,000 tons. Export business is expected to improve with the easing off of freight rates.

Buffalo.—While the total quantity of iron sold does not equal that of the preceding week, a good business has been done. Most of it has been in foundry and malleable grades. One sale of 7,000 tons malleable is reported, the price being $27.75.

St. Louis.—Purchases are confined to small lots from carload to 200 tons, for immediate requirements. Furnace men are not pushing sales at the present prices, and consumers are not showing much anxiety to buy. The largest enquiry is for 2,000 tons from a stove concern.

New York.—Trading has not been so active during the past week, the aggregate of foundry iron having reached about 35,000 tons. While freight rates are declining, exporters are finding it difficult to get replies to their cables. Furnaces are not making any concessions for last half business.

Cincinnati.—Sales have not reached the standard of the past few weeks, though enquiry for last half foundry is good. Four thousand tons for August-September delivery are being sought by the Standard Sanitary Manufacturing Co. Schedule price is being maintained on high silicon grades, which are in good demand.

Cleveland.—Numerous sales of round tonnages, mostly for last half, have featured an active week's trading. Sales of 130,000 in the first two weeks of June are reported by two sellers. Some sales have been made for first quarter 1920. Steel-making grades are quiet.

45,000 SHOWERS

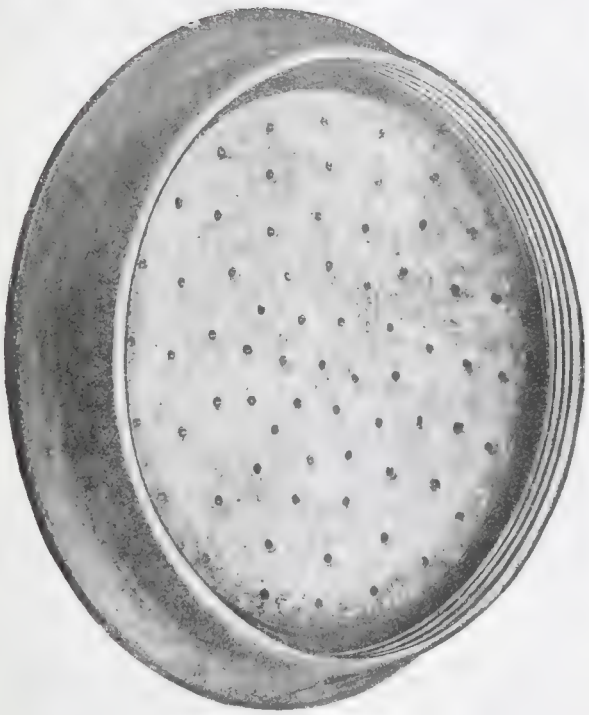
A Manufacturer Gives the Details of Filling a U. S. Government Order for 45,000 Shower Heads, Using Geometric Die Head and Collapsing Taps.

"On the main thread of the shank 3⅜"-16, we average 230 per hour, with a surface speed of about 400 feet per minute. On the pig iron end we averaged 220 per hour, with a surface speed of about 200 feet per minute. This speed may seem a little low, but we cut this down in order to get a quicker handling of the work. We handled these in air chuck, and in releasing air chuck the work automatically dropped to a box below.

"On the face, tapped 3⅜"-16, we averaged 210 per hour, with a surface speed of about 400 feet per minute.

"We were very much pleased with the Geometric tools on this work, especially with the chasers, as we completed 30,000 showers, male thread, with one set of these chasers."

Try a Geometric Thread-Cutting Die Head or Collapsing Tap on your work, and be equally pleased.



The Geometric Tool Company

New Haven, Conn., U.S.A.

CANADIAN AGENTS:

Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.

C.A.S.E. GATHERING AT BRANTFORD WAS A MOST SUCCESSFUL EVENT

THE busy manufacturing city of Brantford was the place chosen for the 30th annual convention of the Canadian Association of Stationary Engineers, which was held on the 24th, 25th, 26th June.

The local lodge, Brantford No. 4, which had the arrangements in hand, rose to the occasion, overcoming quite a number of severe handicaps in ensuring a successful meeting. Not the least of these obstacles was the influenza epidemic, which laid the members of the lodge by the heels one after the other. Just to show that they were superior even to influenza, the local committee commandeered the Emergency Hospital building to hold the convention and power exhibition in. Needless to say, the last remaining germ was driven forth before the convention assembled, and the building made a very suitable place for gathering the various mechanical exhibits.

The Exhibits

The number of firms exhibiting power plant accessories and appliances were as numerous as in former years, and the quality of the exhibits compared favorably with any previous exhibition. The opportunity for getting acquainted with the latest aids to economical power production was appreciated by some of the delegates, but on the whole the attention given was not all that might be desired.

The business of the C.A.S.E. delegates to the Grand Lodge was carried on in private sessions during the three days, the election of officers taking place on the morning of the last day. The place of meeting for the convention of 1920 was chosen at Woodstock, Ont.

The executive officers of the Grand Lodge, C.A.S.E., were elected as follows:

Past president—W. Cook, Belleville.
President—Geo. E. Moll, London.
1st vice-pres.—I. J. Tait, Montreal.
2nd vice-pres.—D. L. Webster, Brantford.
3rd vice-pres.—Fred Harper, Kingston.
Sec.-treasurer—John Hale, Hamilton.
Conductor—Ross C. Leach, Toronto.
Doorkeeper—Geo. Lee, Ottawa.

Mr. W. Cook was chosen as a delegate to the National Association of Stationary Engineers, with Mr. Balmfirth, Toronto, as alternative delegate.

The Exhibitors' Association also elected their officers for the coming year, the results being as follows:

President—Jas. Mock, Montreal.
1st vice-president—J. E. Fitzgerald, Montreal.
2nd vice-president—Grant Cole, Toronto.
Treasurer—L. L. Archibald, Toronto.
Secretary—Gordon C. Keith, Toronto.
Asst. Secretary—Geo. M. Wilkinson, Toronto.
Chairman Exhibits—A. Betton, Toronto.
Committee Exhibits—E. Hanson, Toronto; H. Fletcher, Toronto.
Entertainment Com.—Chairman, Bertram Curzon, Montreal; H. Burbridge, Montreal; H. W. Cockfield, Toronto.
Reception Com.—Chairman, R. Sexton, Toronto; J. Thompson, Earl Gordon, Hamilton.

The Entertainment Committee of the Exhibitors' Association provided a varied programme of amusements during the convention. The final event, under the auspices of the Brantford Lodge, was the annual ball. This was held in the Masonic Hall, and was very well attended, forming a fitting wind up to a successful and pleasant convention.

CANADIAN ELECTRICAL ASSOCIATION DISCUSSED WIDE VARIETY OF MATTERS

The annual convention of the Canadian Electrical Association was held on June 27 and 28 at Alexandria Bay, Thousand Islands, this location providing a delightful outing for the members in combination with the necessary business meetings. The programme consisted largely in the presentation of reports from committees much as former years. These reports were submitted from the committees on accident prevention, prime movers, electrical apparatus, meters, rate research and light and power sales.

Progress has been made in the field of prime movers during the last year. Larger turbo-generators have been installed, and while this has been the case, operating troubles have been experienced. These troubles have in some measure been caused by the necessity for employing inexperienced help owing to war conditions. More rigid inspection is being carried out. Higher steam pressures are much in evidence and the development of still higher pressures seems to be a matter of boiler design.

The water turbine has seen little development in the last year, but the use of high specific speed vertical single-stage runners is rapidly becoming standard for all low-head installations.

A very important feature, and one around which much discussion arose, had to do with the newly-appointed engineering standards committee at Ottawa. The electrical industry could be materially benefited by co-operation with this committee and by the adoption of standards tending towards elimination of useless features of design.

Power sales of various large companies are practically as good to-day as when the armistice was signed. The signing of the armistice rendered a decrease in power sold inevitable for a short time, but this was almost wholly regained before the close of 1918.

Industrial lighting has received a considerable impetus, and well-designed lighting installations have been a material factor in the production of munitions. Greater attention will necessarily have to be devoted to this subject by the industry in the future if production is to be maintained.

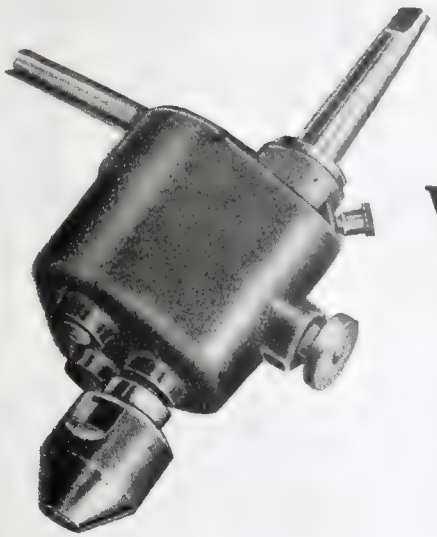
One of the most interesting features of the convention was the paper delivered by E. P. Fredericks on "Service at Cost Plan as Applied to Public Utilities." This plan in brief guarantees the return of a fair amount on capital to the investor, insures an economically-managed plant and protects the public from extortion. While new in some parts of the country, the scheme has been well tried in a dozen or more cities and has been found to be the only solution of the urban transit problem. Various methods have been adopted to ensure satisfactory operation but in practically all of them street railway fares fluctuate at six month or longer intervals, according to the state of a reserve fund.

CONTROLLING CANADIAN SHIPPING NOT TO INTERFERE WITH BUILDING

MR. BALLANTYNE has introduced an amendment to the Canada Shipping Act providing that a shipowner wishing transfer of registry or of mortgage, must apply to the Minister of Marine to get it. In doing this Canada is following the precedent of Great Britain, the action being taken in order that there may be assurance none of our shipping will get into foreign hands. Under the provisions of the bill a foreign company applying for the registry or transfer of a ship must come to Ottawa and apply to the Minister, so that the bona-fides of the applicant and all particulars may be investigated. The bill is to remain in force for three years after the signing of peace.

Objection to the bill was made by Mr. Duff, of Lunenburg, an old opponent of the Minister's, who conducted a spirited attack on the Naval Department this session. He claimed that it would put many wooden shipyards out of business. Most of the wooden ships built in Canada are for sale, and not intended for the Canadian trade. He said it would work a hardship on shipowners. A ship might be in Brazil or France and a sale made by telegraph through the captain, which would require immediate acceptance. Application to Ottawa as required by this bill would, in Mr. Duff's opinion, create such delay as to make sale impossible or difficult.

Continued on page 80



Aikenhead's

Wahlstrom Attachment

Reduces Tap Breakage
Increases Tapping Speed

Taps holes as squarely as they can be drilled and ten times faster than is possible by hand. Its action closely imitates hand tapping, because of the mechanically obtained **oscillating movement** and it minimizes tap breakage.

The quality of material and construction assures a long lasting trouble-free service.
Takes taps of all sizes up to 1½ inch.

Send for Bulletin.

Order One On Trial
Your Money Promptly Refunded if Unsatisfactory

AIKENHEAD HARDWARE, LIMITED
17 Temperance Street, Toronto

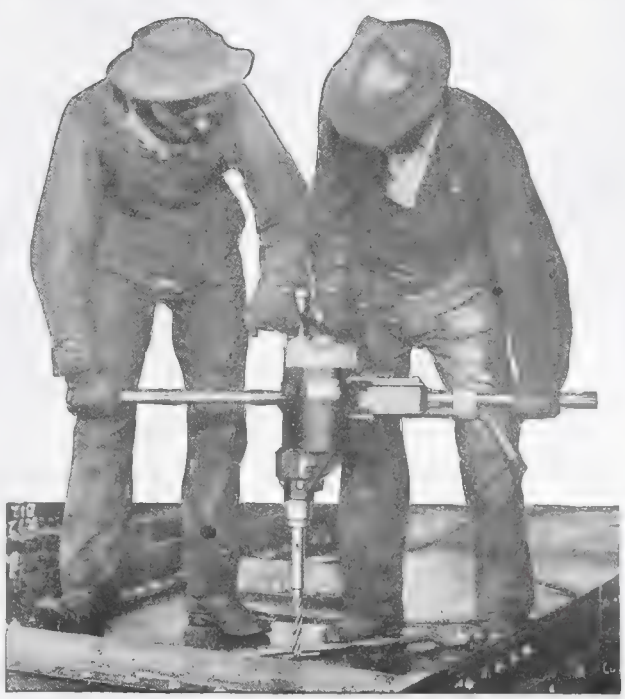
Aikenhead's

Van Dorn Portable Electric Drills

Works 50% faster than the best pneumatic drills, known amongst actual USERS as thoroughly reliable, fool-proof and trouble-proof.

You cannot go wrong with a Van Dorn Electric Drill.

Catalogue sent upon request.



Aikenhead Hardware Limited
17 Temperance Street TORONTO

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	....
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price:—	
Silicon..2.25% to 2.75%	$32.75 to $35.75

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 25
Steel bars, base, Toronto	4 25
Steel bars, 2 in. to 4 in. base	5 50
Steel bars, 4 in. and larger base	6 00
Iron bas, base, Montreal	3 75
Steel bars, base, Montreal	3 75
Reinforcing bars, base	4 50
Steel hoops	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Brand steel, No. 10 gauge, base	4 40
Chequered floor plate, 3-16 in.	6 50
Chequered floor plate, ¼ in.	6 25
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 50
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 lbs C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

Lake copper	$22 00	$21 00
Electro copper	21 00	20 75
Castings, copper	21 00	18 00
Tin	55 00	55 00
Spelter	9 25	8 50
Lead	7 25	6 50
Antimony	9 50	9 50
Aluminum	36 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ½ up	$ 4 50	$ 4 50
Plates, 3-16 in.	4 90	4 90

Price List No. 38

Standard Buttweld

	Per 100 feet	
⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit
Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland
Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
tandard couplings, 4" and under 40%.
4½" and larger, 20%.

OLD MATERIAL

Dealers' Buying Prices.

	Per 100 Pounds Montreal	Toronto
Copper, light	$12 50	$12 00
Copper, crucible	16 50	15 00
Copper, heavy	16 00	15 00
Copper wire	16 00	14 50
No. 1 machine composition	12 75	14 00
New brass cuttings	9 25	9 00
Red brass turnings	10 00	9 00
Yellow brass turnings	7 25	6 50
Light brass	6 00	5 00
Medium brass	7 00	6 00
Scrap zinc	5 50	5 00
Heavy lead	4 50	4 00
Tea lead	3 50	3 00
Aluminum	15 00	12 00
	Per To	
Heavy melting steel	10 75	9 00
Shell turnings	6 00	6 00
Boiler plate	10 00	8 00
Axles (wrought iron)	17 00	15 00
Rails	12 00	11 00
Malleable scrap	12 00	12 00
No. 1 machine cast iron	18 00	15 00
Pipe wrought	8 00	5 00
Car wheels	20 00	18 00
Steel axles	20 00	20 00
Mach. shop turnings	5 50	5 00
Stove plate	14 00	10 00
Cast boring	5 50	8 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	35
Carriage bolts, 7-16 and up	15
Coach and lag screws	50
Stove bolts	65
Wrought washers	50
Elevator bolts	25
Machine bolts, 7-16 and over	40
Machine bolts, ⅜ and less	40
Blank bolts	25
Bolt ends	25
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl and rd hd., brass	net
Machine screws, o. and fil hd brass	net
Nuts, square blank	add $0 75
Nuts, square, tapped	add 1 00
Nuts, hex., blank	add 1 00
Nuts, hex., tapped	add 1 25
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

Set screws	50
Sq. and Hex. Head Cap Screws	45
Rd. and Fil. Head Cap Screws	20
Flat But. Hd. Cap Screws	10
Fin. and emi-fin. nuts up to 1 in.	45
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	40
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	25
Studs	30
Taper pins	50
Coupling bolts,	10
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 70
Cut nails	4 75
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 37
British Manila rope	0 31
New Zealand hemp	0 31
Transmission rope, Manila	0 43
Cotton rope, ¼-lb. and up	0 74

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... **net**

ILLINOIS TOOLS

"ILLINOIS" Formed Cutters are noted for their accuracy, dependability and durability. Our engineer-experts insure those qualities, from the selection of the high speed steel to the final testing of the finished tool, no matter how unusual the requirements or design. That's why "Illinois" stands for infallibility in tools.

ILLINOIS TOOL WORKS
CHICAGO, U. S. A.

Woodward and Warren Aves.

A. C. Towne, Inc.
17 W. Swan St. Buffalo

S. J. Platt
Pioneer Bldg., St. Paul.

Rose Tool and Supply Co.
111 Market St., Pittsburgh

Louis G. Henes
75 Fremont St. San Francisco.

Title Insurance Building,
Los Angeles

Indianapolis Office
616 Fletcher Sav. & Trust Bldg.

New York Office
141-145 West 36th St.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 10
Linseed oil, raw, single bbls.	1 70
Linseed oil, boiled, single bbls.	1 73
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sies up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40 plus 10
Standard drills, al sizes	40 plus 10
3-fluted drills, plus	10
Jobbers' and letter sizes	40 plus 10
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	list plus 10
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 50
Canadian high speed cutters	net
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 00
Sheets, black, No. 10	5 15	5 45
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	.....	.....
Queen's Head, 28 B.W.G.	.....	.....
Fleur-de-Lis, 28 B.W.G.	.....	.....
Gorbal's Best, No. 28	.....	.....
Colborne Crown, No. 28	.....	.....
Premier, No. 28 U.S.	.....	7 95
Premier, 10¾ oz.	.....	8 25
Zinc sheets	20 00	20 00

PROOF COIL CHAIN B

¼ in., $14.35; 5-16 in., $13.85; ⅜ in., $13.50; 7-16 in., $12.90; ½ in., $13.20; $13.00; ⅞ in., $12.90; 1 inch, $12.65; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $13.00; 3-16 in., $12.50; ¼ in., $11.75; 5-16 in., $11.40; ⅜ in., $11.00; 7-16 in., $10.60; ½ in., $10.40; ⅝ in., $10.00; ¾ in., $9.90.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$25 00	$.....
1¼ in.	27 00	.....
1½ in.	28 00	26 00
1¾ in.	30 00	26 00
2 in.	30 00	26 00
2¼ in.	33 00	28 00
2½ in.	40 00	32 00
3 in.	46 00	38 00
3¼ in.	.....	45 00
3½ in.	56 00	42 00
4 in.	70 00	54 00

Prices per 100 ft., Montreal and Toronto les 10.

OILS AND COMPOUNDS.

Castor oil, per lb.	.....
Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	27½
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	10¼

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	3 25
Polishing wheels, bull-neck	2 00
Emery in kegs, American	07
Pumice, ground	3½ to 05
Emery glue	28 to 30
Tripoli composition	06 to 09
Crocus composition	08 to 10
Emery composition	08 to 09
Rouge, silver	35 to 50
Rouge, powder	30 to 45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.06

BRASS

Brass rods, base ½ in. to 1 in. rod	0 30
Brass sheets, 24 gauge and heavier, base	$0 38

WASTE

Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS.

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS.

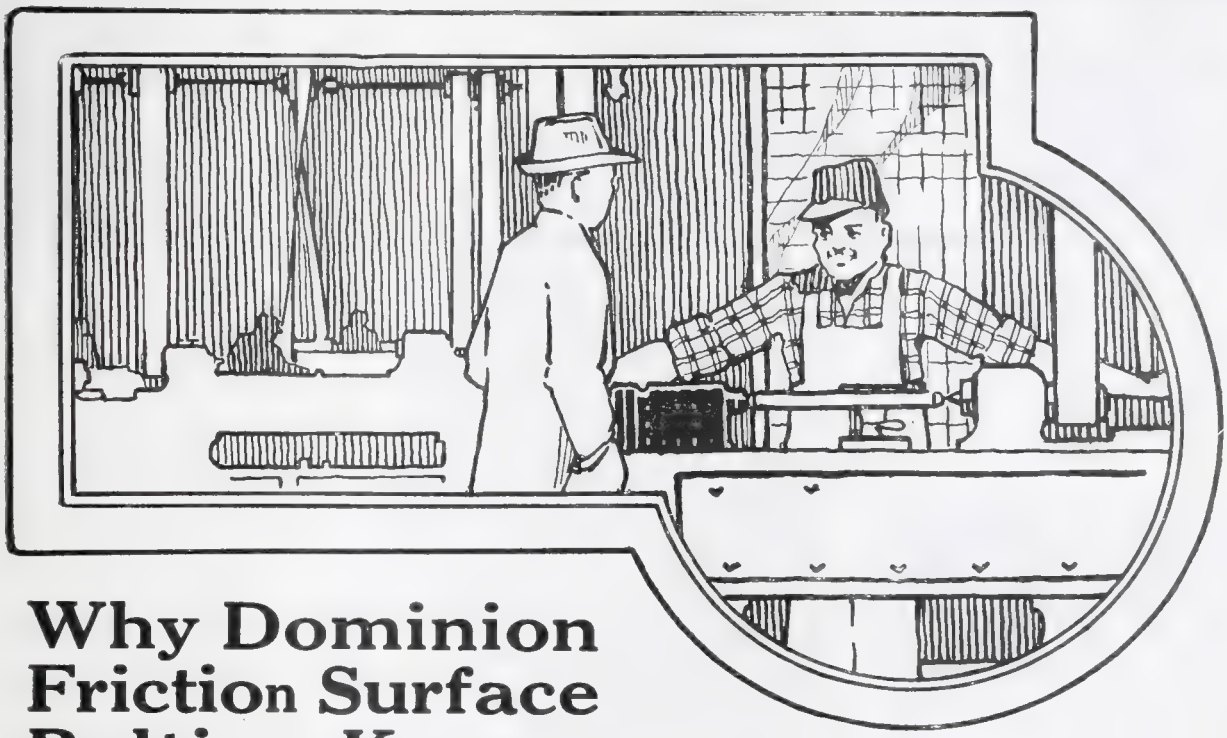
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 25	$11 50
Sheets, 3½ lbs. sq. ft.	10 00	11 00
Sheets, 4 to 6 lbs. sq. ft.	9 75	10 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium carbonate	.
Ammonium, chloride	.55
Ammonium hydrosulphuret	.30
Ammonium sulphate	.15
Arsenic, white	.27
Copper, carbonate, annhy	.50
Copper, sulphate	.22
Cobalt, sulphate	.20
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel carbonate	.32
Nickel sulphate	.35
Potassium carbonate	1.80
Potassium sulphide (substitute)	2 25
Silver chloride (per oz.)	1.45
Silver nitrate (per oz.)	1.20
Sodium bisulphite	.15
Sodium carbonate crystals	.05
Sodium cyanide, 127-130%	.40
Sodium hydrate	.22
Sodium hyposulphite, per 100 lbs.	6.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.



Why Dominion Friction Surface Belting Keeps Employees Satisfied

There are few manufacturers who haven't discovered that satisfied employees are an absolute necessity to low cost of production.

But poor equipment will not keep employees contented — it will not permit maximum production — it increases upkeep cost — it creates needless waste of time for operators and machines while making repairs.

Dominion Friction Surface Belting, in eliminating these conditions, does much to keep employees satisfied, for it enables operators to turn out maximum production at low cost — does away with most transmission troubles and saves power by taking a grip on pulleys that practically prevents all slipping.

Our Belting Experts are ready to show you how this "plus service" belting will keep your employees satisfied, just as they have for many other manufacturers. Phone, wire or write to our nearest service branch—there is no obligation.

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Montreal,	Kitchener,	Regina,	Vancouver,
Ottawa,	North Bay	Saskatoon,	Victoria

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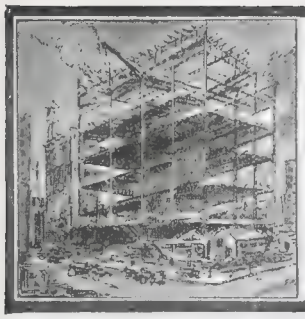
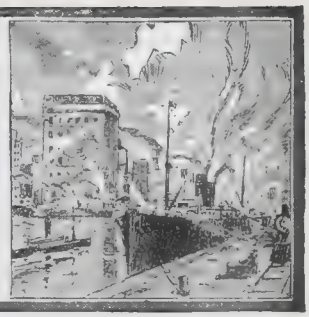


INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

New Pulp Mill.—Five million dollars are to be spent by the Spruce Rock Falls Pulp and Paper Company, who will start on July 15th on the erection of a large mill and townsite, near Kingston, Ont.

C.P.R. Buys Land.—An additional eighteen acres has been acquired by the Canadian Pacific Railway at Swift Current, Sask. The property is located south of their tracks and west of the North and South highway. What use is to be made of it is not divulged.

Dominion Foundry to Close.—The Dominion Foundry plant at Hamilton will be closed down for two weeks in July while electric ovens are installed. Not many men will be affected, as the plant has been running light for some months. It is reported that the company intends to operate rolling mills in the course of a couple of months.

New Flour Mill.—Mr. R. M. Pincombe of Strathroy has purchased the property belonging to the estate of the late John Mills, adjoining the G.T.R., and will erect a flour mill having a capacity of 250 barrels per day. The mill will be operated by hydro power, and be thoroughly up-to-date in its equipment. The grain elevator will be moved from its present position to a site adjoining the new mill.

New Brunswick Telephone Construction.—An expenditure of between $150,000 and $200,000 will be made this year by the New Brunswick Telephone Company, according to officials who are on a tour through the St. John Valley. New copper circuits from Bathurst to Dalhousie and St. John to Moncton are included in the estimates, which will improve the service and allow for extensions to existing lines.

Bertram's Annual Pic-nic.—The annual pic-nic of the employees of the Bertram and Pratt and Whitney's, one hundred and fifty strong, motored out from Hamilton to Grimsby, where a programme of sports and races was gone through. A baseball match between representatives of the two firms was won by the P. & W. team, who received a beautiful silver cup as the result of their endeavors. Refreshments were served, and the day was voted a great success.

C.N.R. Construction.—The only thing delaying construction on the Kamloops-Kelowna branch of the C.N. Railway is the unsettled state of the labor market. Contractors and sub-contractors are now in their appointed localities, and will start work just as soon as they can secure the necessary help. Major Swan, the divisional engineer, states that every effort will be made to complete the whole section by the fall of 1920, but in any case the Lumbly spur will be made available for marketing fruit this fall.

Who is the Owner?—The New Glasgow "Chronicle" wants to know who is the real owner of the cars now being built by the Eastern Car Co. for the Canadian Government and labelled Canadian National. It points out that on a recent shipment of cars the legend "Canadian Northern Railway" appears. On the flat cars now being built is the name of "General Trust Co., Trustee, Owner and Lessor, Philadelphia, Penn." On the gondola cars still another title appears, "Property of Canadian Northern Rolling Stock Co., Ltd."

Erect Fuel Factory.—The Anthracite Briquette Company will start building immediately on the new industrial site of the Toronto Harbor Commission a factory for the making of compressed anthracite briquettes. Large supplies of waste anthracite have been secured, and the plant will have at first a capacity of ten tons per hour. The rights of a patented binder have been secured from the United States. The use of these briquettes will, it is claimed, make a big saving in the cost of fuel. Some of the best brains of the chemical staff of the Toronto University have been connected with the process, and it is understood to be a first rate commercial proposition. The capital is all privately subscribed.

Ontario's Production.—In the annual report to the British Parliament, F. W. Field, the British Trade Commissioner, gives some interesting figures. Ontario gives 46 per cent. of the mineral production of Canada, and 30 per cent. of the wool clip. One-half of the manufactured goods are made in Ontario, and one-third of the agricultural product is grown here. Ontario yards received 30 per cent. of the shipbuilding orders.

To Build New Hospital.—Toronto intends to build a new reception hospital, and Controller Cameron presented a motion that the city architect be instructed to prepare the necessary plans and estimates. An extension to the Civic Abattoir is also contemplated, at an estimated cost of $50,000.

May Arbitrate Now.—Mr. F. G. Wallace, president of the Canadian Locomotive Company, Kingston, has replied to the letter sent him by the committee appointed by the City Council to endeavor to bring about a settlement between the company and its striking employees. Mr. Wallace, in thanking the committee for its kind offer, says that the time is not opportune for outside intervention, and continues as follows: "Had we refused to meet our employees, your committee might have been of great assistance, but our men fully understand that they can arrange a meeting with us at any time they so desire. Under these circumstances you will readily see that it is impossible for us to avail ourselves of your kind offer." The Strikers' Committee has written the Council's Committee that it is ready to negotiate its differences.

MUNICIPAL

Pembroke is going to have a new lighting system.

A memorial club house, costing $35,000, will be built at Brampton.

Work is being commenced at once on extensions to the rail mill at the Algoma Steel Corporation.

Sarnia is going to vote on July 4 on by-law for new collegiate and technical school to cost $350,000.

The Township of York call for tenders for the construction of a number of cast iron water mains. Frank Barber, 40 Jarvis St., Toronto, is the engineer.

Niagara Falls, Ont., contemplate making improvements to the electric light plant and system. Debentures for some $18,000 will be issued to provide for the work.

The Town of Aurora, through James, Loudon & Hertzberg, 36 Toronto St., Toronto, are in the market at once for a centrifugal pump of 750 gallons per minute capacity, to be driven by a gasoline engine.

PERSONALS

Alex. Lentz, for the past five years secretary and manager of sales of Brown's Copper and Brass Rolling Mills, Limited, Toronto, has resigned that position, effective July 1st, and will be associated with the Kent, Ockley, Limited, Toronto, as vice-president secretary and treasurer.

MARINE

Collingwood.—The Collingwood Shipbuilding Company launched the "Canadian Signaller" from their Collingwood yard, making the fourth ocean-going steamer to leave their ways this year.

Detroit.—The steamer J. T. Hutchinson loaded with ore has gone ashore on Trout Island shoal, and is leaking badly. A wrecking steamer from Sault Ste. Marie has gone to her assistance. The steamer Major is also reported to be off the port of Lexington, and a steamer from Port Huron has gone down to help her off. She went ashore in a thick fog.

Victoria. — The Foundation Company had a successful launching of their eighth ship recently when the Ottawa was put in the water. This is the eighth ship out of the twenty building for the French Government. The launch was in charge of the assistant Northwest manager of the Foundation Company, Mr. Edward E. Jenkins. The sponsor was Mrs. W. J. Stephens.

Washington.—The American Bureau of Shipping, which has been formed in the U. S. on somewhat similar lines to those of Lloyd's Register in Great Britain, is expected to do great things for American shipping. Commodore E. P. Beethold, commandant of the Coast Guard, will take charge of the Bureau, and is retiring from his present position on June 30th for this purpose.

Victoria.—The first of the twenty ships building by the Foundation Company for the French Government made her steam trials recently. The course used by the Imperial Munitions Board was the one chosen. The vessel on trial was Hull 207. Hull 216 will be ready to take her trials early in July, and there are several other hulls waiting their turn at the fitting-out shed.

Victoria.—The Canadian Merchant Service Guild has been incorporated at Victoria, and will be incorporated with the other branches of the guild, making it one big organization. The headquarters of the Western body will be at Victoria, the Middle East at Collingwood, and the Eastern at Halifax. There are already 500 members in the Western body, which embraces the entire coast and lakes of British Columbia.

Victoria.—An unusual scene was witnessed recently when the Prince Rupert was being loaded for her trip to the North. The officials of the Grand Trunk Railway, from C. E. Jenney, the general agent of the company at Vancouver, turned to and assisted in getting the freight and baggage aboard the vessel. The vessel was bound for Vancouver and Prince Rupert, and carried a large number of passengers, as well as supplies for the Northern ports.

London, Eng.—In reply to a question in the House of Commons, Mr. Bridgeman, Parliamentary Secretary to the Board of Trade, said that the resolution of the Imperial Conference with reference to steamship lines did not aim at creating either lines or subsidies. It simply urged that the best mail service possible should be given, between Canada, Newfoundland, and Australia. An Imperial Investigation Board was being created, which would deal with these questions.

Ottawa.—Although the war is over, the amount of shipping passing through Canadian ports under the control of the Canadian Director-General of the British Ministry of Shipping is larger for the first five months of 1919 than it was in the demobilization period of 1918. The total tonnage for the five months is 1,804,995 tons, nearly as much as the total tonnage for the year of 1916. The total amount of material and supplies, exclusive of horses and mules, cleared from Canadian ports since August, 1914, to May, 1919, is 14,044,758 tons.

Montreal warehouses are filled to capacity with freight waiting for shipment. This is due to the shortness of tonnage, and there is no prospect of immediate relief. The British Ministry of Shipping still controls 70 per cent. of the available cargo space, and it is a strenuous job for the steamship companies to divide out the remaining 30 per cent. without hurting the feelings of at least some of their clients. Col. W. I. Gear, of the Robert Reford Co., states that the Cunard line has chartered and purchased every available ship, while the Donaldson and Cairn lines each expect a new ship about August.

Vancouver.—Addressing the retail bureau of the Board of Trade at a luncheon, Commissioner McClay stated that the construction of harbor facilities would be started as soon as the Government allocated the $5,000,000 appropriation to the work. These facilities consisted of a terminal railway, four new deep sea berths with fire-proof sheds, a lumber assemblage wharf for export lumber, a large central booming ground for saw logs, oil storage tanks for non-inflammable oils, and the purchase of a suitable fire and tug boat combined. The speaker in calling attention to the importance of shipping to the port, mentioned that a ship of the Robert Dollar Line spent as much as $40,000 in the port each trip.

TENDERS

Board of Trustees, Pathfinder School District No. 3690, Manville, will receive tenders up to July 12th for the erection of a frame school building. Plans and specifications from the office of the Secretary-treasurer, Manville.

The town clerk of Oakville will receive tenders up till July 7th for the supply of material and construction of tarvia or asphalt macadam pavement on six streets. Plans and specifications at office of town clerk, Oakville, or Jas. A. Bell and Son, St. Thomas, Ont.

The City of Toronto require tenders, by registered post only, up to July 8th,

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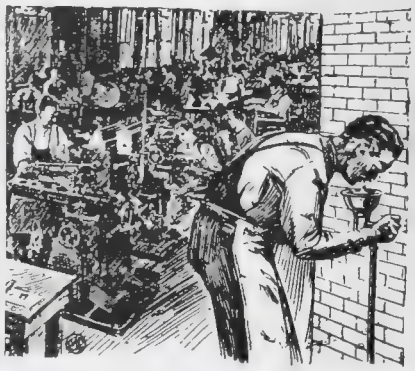

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PURO SANITARY DRINKING FOUNTAIN

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Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills too. You can attach it in a few minutes. Tell us how many men, how many departments and we'll tell you how much the cost will be.

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for asphalt, bitulithic brick block and track allowance pavements; also concrete sidewalks. Specifications and forms can be obtained at the Dept. of Works, City Hall. Tenders to be addressed to Chairman Board of Control.

The Department of Railways and Canals ask for "Tender for Tugs," tenders to be in by July 7th for two tugs from 250 to 400 h.p. each. Not less than 75 feet or more than 100 feet in length, 18 to 22 feet beam, and nine to 10½ feet draught. To have compound or triple expansion condensing engines, and to carry not less than 125 lbs. steam pressure. Accepted cheque for $1,000 to accompany each tender. Complete specifications, boiler inspection report, and place where tug can be inspected to accompany tender.

CATALOGUES

The Bastian-Blessing Company, Chicago, have issued a pamphlet entitled A New Principle in Welding and Cutting Apparatus. This publication takes up the principles on which their torches operate and also gives the advantages resulting from this apparatus.

The Foster Instrument Co., Letchworth, Herts, England, have issued a very practical chart on the care and use of pyrometers. This chart, suitable for hanging up in the works, contains hints on the use of pyrometers of various types, such as radiation thermo-couple and electric resistance, and also has a useful Fahrenheit-Centigrade conversion chart ranging from 50° to 3550° Fah.

CONTROLLING CANADIAN SHIPPING

Continued from page 72

The Minister allayed his fears somewhat by saying that there would be no delay. The incident opened up a very interesting discussion on shipping, in the course of which some very interesting information was elicited. Mr. Duff said that there was a lot of American money which might be put in Canadian shipping if encouraged. He himself knew of one Boston man willing to invest fifty thousand dollars in Nova Scotia ships.

Mr. Ballantyne assured Mr. Duff and other critics that there would be no interference or delay, as it was the policy of the Government to increase all Canadian shipbuilding. But a certain amount of caution had been shown to be necessary. One of the neutral countries had applied to Canada for registry for a ship which it was found was to engage in enemy trade. The principal object of the bill was to see that none of our ships get into the hands of enemies, and to conserve Canadian tonnage for Canada as much as possible.

Michael Clark objected to the principle that we should try and prevent the enemy countries getting shipping facilities; without them they could never export the goods to pay the indemnities, but the Minister insisted that if he received an application from Germany or

Austria, he would refuse it. During the course of his speech he remarked that a large number of wooden ships had recently been transferred from Canadian to Newfoundland registry, which involved a stay of the man concerned only three hours in Ottawa. He assured Mr. Duff that there would be no trouble in any case.

During the debate on the budget the member for South Cape Breton, where the coal and steel works are located, brought up the matter of Canadian shipping commandeered by the British Government during the war, and not yet returned, though badly needed. The Nova Scotia and Dominion companies have lost control of the St. Lawrence coal trade, which has passed to American interests, through lack of shipping. The ships taken were under long contract. The matter has since been brought up in the House and the Premier made a statement, in which he left the impression that the Government was doing everything possible to get the ships out of the hands of Great Britain, but it was hanging on to them like grim death. Mr. Ballantyne and others stated pretty frankly their opinion of the spirit which insisted on retaining the ships to the profit of those who have them, but to the loss of Canada.—T.M.F.

GREAT LAKES TRANSPORTATION COMPANY

Mr. John Bell, who is in charge of this firm's business at Fort William, seems to have been causing a great deal of activity around the river since he took over the ice-breaking contract last fall. We understand he will have three tugs in commission during the summer months and a very fine steel tug is being built in Midland specially designed to keep the harbors at Fort William or Port Arthur open as late, or early, as may be found necessary.

Mr. Bell is getting together a very fine salvage outfit, and while not employed in that special work it will be kept busy towing sand and gravel from the North Shore of Lake Superior.

CONCRETE CHIMNEYS AND LIGHTNING

A concrete chimney, 6 ft. by 120 ft., was struck by lightning recently, and though without lightning rods it was not injured in the least. The chimney stands in the midst of greenhouses, and if it had been brick, there would undoubtedly have been some lost glass.

Commissioner Chisholm's Remedy.—Riverdale and other parts of Toronto have been suffering considerably from the effects of the soot deposited by the smoke from the many locomotives working in the vicinity. A test case is being brought against the C.P.R., to see if the city by-law cannot be enforced against the company for operating locomotives that give forth more smoke than the law allows. Commissioner Chisholm suggests the electrification of all railroads coming into the city as the only remedy.

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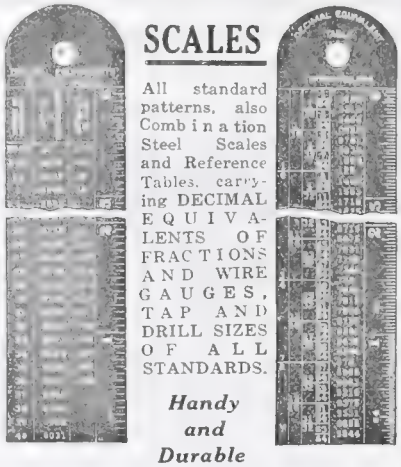

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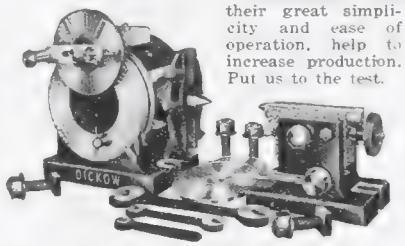

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Alley & McLellan Air Compressor 600 ft. at 100 lbs. pressure, 125 H.P. Motor, heavy duty 600 R.P.M. 3 phase 60 cycle 550 volts.
Ingersoll-Rand 800 ft. Air Compressor.
1 Tube Mill Fraser & Chalmers 5 x 22
1 Power & Mining 5 x 22.
Also large assortment of Pumps, Tanks, Classifiers, Boilers and Mining Equipment for sale.

Zenith Coal & Steel Products
Limited
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Used locomotive crane.
Engine—Double-cylinder, 9" x 12" stroke.
Boiler—Vertical, new tubes, hood and smoke-stack, good for 100 lbs. working pressure.
Bucket—¾-yard, boom 58 ft. 6 in. long, wheel base 14 ft., gauge 14 ft.; hoisting and slewing gears in good condition.
All motions operated from one platform.
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LOCOMOTIVE

For sale, one 35-ton shunting locomotive, complete with trailer, tender, air pump, etc.

In good operating condition, can be seen and all particulars obtained at the plant of

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WANTED TOOL ROOM FOREMAN ON automobile drop forge dies and general machine work; must be skilled in close work; state age, salary expected, where last employed and in what capacity. Box 611, Canadian Machinery.

MECHANICAL DRAUGHTSMAN REQUIRED with experience in gasoline engine design. Knowledge of farm machinery desirable. Apply in the first instance with full particulars regarding experience, salary required, etc., with copy of references, to Box 612, Canadian Machinery. (c1m)

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery (cfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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A CANADIAN MANUFACTURER OF MACHinery for the use of Contractors, Miners, etc., is open to undertake the manufacture of any other machinery or device for the use of either contractors or miners, and invites correspondence with holders of Canadian patents, or with U. S. concerns desiring a Canadian manufacturing agency. Liberal inducements also offered for successful suggestions regarding machinery or other articles that can be manufactured and sold in connection with the above-mentioned lines. Address Box 610, Canadian Machinery. (c2m)

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MACHINE WORK WANTED FOR LATHES shapers, milling machine and planer, etc Hourly or contract basis. Prompt delivery. W. H Sumbling Machinery Co., Toronto (ctfm)

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FOR SALE—One used lighting unit, consisting of one 25 K.W., 125 volt, 200 ampere direct current generator to operate at speed of 320 to 350 r.p.m. Generator made by Westinghouse Company. This machine is directly connected with a Goldie & McCulloch 9x10 Ideal engine. This machine can be examined and all particulars obtained at the plant of

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1 Babcock & Wilcox Water Tube Boiler, 100 h. p., 36 in. x 20 ft. 0 in., 4 in. Tubes with complete fittings. Working pressure 150 lbs.

1 Blaisdale Air Compressor, 14 x 14 and 22 x 16. 150 r. p. m. Duplex Steam, Compound Air. Steam and air pressure 100 lbs. Displacement 1126 cu. ft. per minute.

1 C. C. Canadian Rand Compressor, 9 x 12. 14 x 12.

1 Matheson Feed Water Heater, 3 ft. x 18 in.

1 Stack, 60 ft. x 30 in. x 3-16 in. Steel.

1 Lidgerwood Single Drum Friction Hoist, 10 x 12.-54 in. and extra piston. Corrugated Drums built to carry 1100 ft. 1 in. rope. Load 4,500 lbs. Maximum speed 800 ft. per minute at 100 lbs. pressure. Including Dial Indicator.

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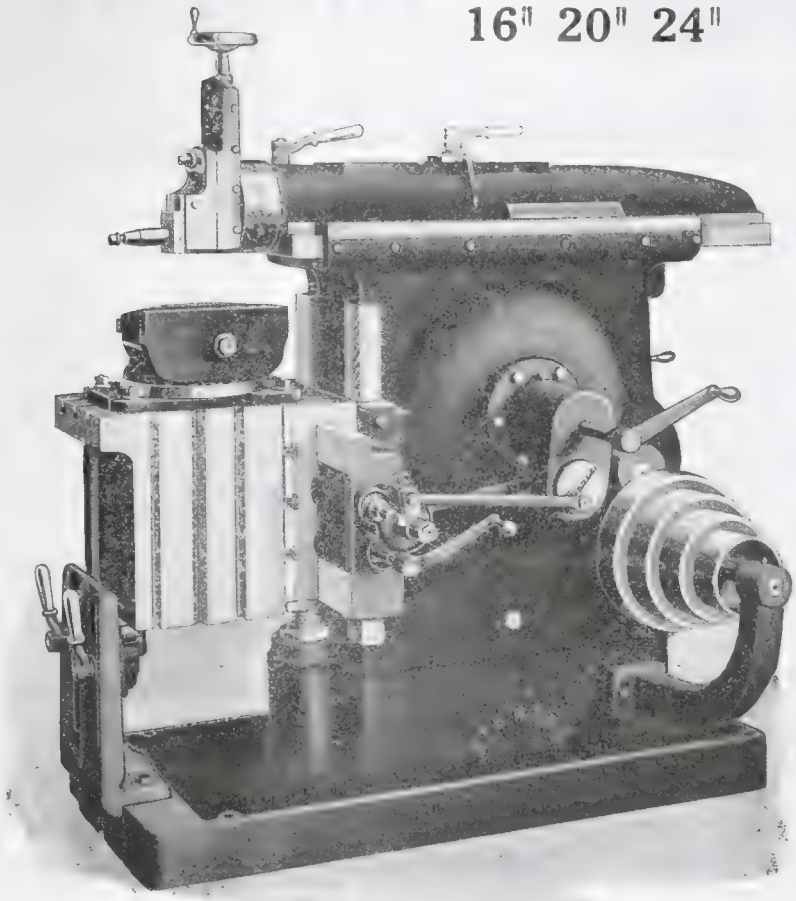
STEPTOE CRANK SHAPERS

16" 20" 24"



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Quick return stroke, adjustable while in motion.

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Every machine is thoroughly tested (1 week) before leaving factory.

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1", 1½", 1⅝", 1¾", Turret Screw Machines.
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Floor and Bench Drill—Presses.
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Burke Millers.
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Entire Plants or Separate Tools

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What have you to offer?

State condition, make and price. We pay cash for any type of machines, motors or belting.

Give full details in first letter.

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1—"Used" Plate Punch and Shear 36" gap, capacity ⅞" hole in ⅞" plate

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Both machines must be modern in design and in good operating condition. Offers with full details, price and shipping point, will be considered.

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ALTERNATING CURRENT UNITS

(ENGINE DRIVEN)

2 and 3 Phase—25 Cycles.

Generator. K.W.	Volts.	R.P.M.	Engine. Cylinder Dimensions.
250	220	214	15 x 22 x 17"
260	220	214	15 x 17"
450	550	125	17 x 34 x 30"
1000	240	107	24 x 48 x 42"

2 and 3 Phase—60 Cycles.

Generator. K.W.	Volts.	R.P.M.	Engine. Cylinder Dimensions.
25	440	1200	8 x 8"
50	2200	300	11 x 19 x 11"
50	2300	300	11 x 12"
100½	240	277	14 x 14"
125	220	225	14½ x 18"
125	240	200	12 x 21"
150	220	225	10 x 20 x 18"
150	2300	225	14 x 22 x 16"
200	2300	200	
300	480	150	14 x 28 x 30"
300	2300	150	18 x 30 x 22"
325	2300	120	24 x 36"
325	2300	150	18 x 36 x 24"
400	600	150	24"
450	2300	100	22 x 42 x 48"
450	550		24 x 36 x 36"
500	480	120	20 x 40 x 36"
600	2300	150	20 x 38 x 24"

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Offices: New York, Pittsburg, St. Louis
Plants: Brooklyn, N.Y., Lincoln, N.J., and Linden, N.J.
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5—Triplex Deane Pumps, 7½" x 10".
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4—200 H.P., 440 Volt, 3 Phase, 25 Cycle.
4 150 " 440 " 3 " 25 "
2 100 " 440 " 3 " 25 "
6 60 " 440 " 3 " 25 "
3 150 " 550 " 3 " 25 "

Also a large number of smaller Motors 25 and 60 Cycle, 220, 440, 550 and 2,200 Volts.

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A large number of Transformers, 6,600 to 550 Volts and 6,600 to 440 Volts.

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A large number of Valves, all sizes, good condition.

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A number of 150, 125 and 100 H.P. Boilers, both H.R.T. and Locomotive.

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Send for Detailed List and Prices.

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HAMILTON ∴ ∴ CANADA

Power Press Bargains

Partial Selection from our Big Stock:

3—Used FERRACUTE D-201 Vertical Double-geared Straight-sided Single-action Redrawing Presses, having capacity for exerting pressure of 200 tons. Length of stroke, 10″. Distance between columns, 32″.

1—Used FERRACUTE D-151 Vertical Double-geared Straight-sided Single-action Redrawing Press, exerting 150 tons pressure. Length of stroke, 13″. Width between columns, 32″.

6—Used FERRACUTE DGG-56 Vertical Double-Geared Straight-sided Single-action Redrawing Presses; 5 of these presses have 18″ length of stroke and 1 has 20″ length of stroke. Distance between uprights, 30″.

7—Used FERRACUTE DGG-56 Vertical Double-Geared Straight-sided Single-action Redrawing Presses, exerting 100 tons pressure; 6 of these presses have 15″ length of stroke and 1 has 12″ length of stroke. Distance between housing, 30″.

6—Used FERRACUTE DGG-55 Vertical Double-geared Straight-sided Single-action Redrawing Presses, exerting 75 tons pressure. Three of these presses have 15″ length of stroke and three have 18″ length of stroke. Distance between housing, 26″.

1—Used FERRACUTE C-5 Open-back Inclinable Cutting Press, Direct Belt Drive., that is, not geared, having capacity for exerting about 50 tons pressure. Length of stroke 2″. Distance from centre of ram back to frame, 12″. Width of opening through back, 18½″. Height of opening through back 7½″.

3—Used FERRACUTE PAG-4 Geared Adjustable Bed Punching Presses, having capacity for exerting 50 tons pressure. Length of stroke, 2″. Distance from centre of ram back to frame, 8½″.

3—Used FERRACUTE PA-3 Adjustable-bed Punch Presses, not geared, having capacity for exerting about 35 tons pressure. Length of stroke, 2″. Distance from centre of ram back to frame, 7″.

1—Used BROWN-BOGGS No. 215 Inclinable Power Press. This is a geared press. Arranged with 24″ x 6″ pulley. Distance back from centre of slide, 9½″. Distance from bed to slide, when up, 13¾″. Width between gibs, 11⅞″. Length of stroke, 4″.

7—Used FERRACUTE D-45 Horizontal Double-end-Screw Press designed for deepening or redrawing sheet metal tubes and shells about 3″ diameter and 18″ deep. Capacity for exerting 100 tons pressure. Three of these presses have length of stroke of 36″ and 4 have length of stroke of 40″. Diameter of ram screw, 6½″. Diameter of side rods, 5″.

2—Used E. W. BLISS No. 60½ Vertical Geared Rack-driven Presses. Length of stroke, 36″.

3—Used FERRACUTE E-57 Vertical Geared Toggle Coining Presses. Length of stroke, 3″.

5—FERRACUTE E-56, Vertical Geared Toggle Coining Presses. Two of these machines have 3″ length of stroke and 3 of them have 2″ length of stroke.

4—Used No. 666 Vertical Geared Toggle Presses, manufactured by the TOLEDO MACHINE & TOOL COMPANY. Having 2¼″ length of stroke and capacity for exerting 1,000 tons pressure on ram.

NOTE:—The above presses were all operating on manufacture of Cartridge Cases when work stopped about nine months ago. They were purchased new from manufacturers from February, 1915, to September, 1915, and have had about two years' service. They were not used continually since being purchased. Some have been repaired and all have been kept in good running order—Examination can be made in Montreal.

TERMS:—25% with order balance against Bill of Lading.

NOTE:—If these presses were to be shipped back to the United States there would be no duty to be paid—You would only require to add freight from Montreal to destination (except Brown-Boggs Press).

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Special Machinery, Gears, Jigs, Fixtures, Punches and Die Smal Tools, Screw Machine Products, Gauges, Etc

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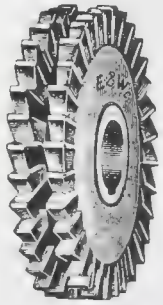
MILLING CUTTERS AND SMALL TOOLS



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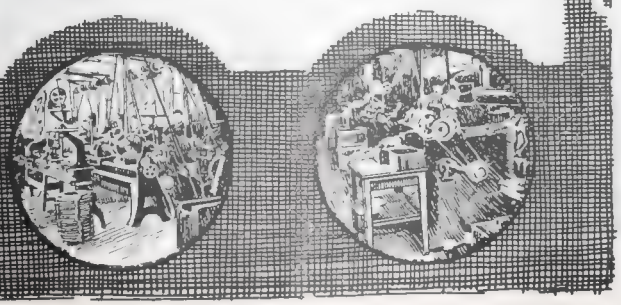

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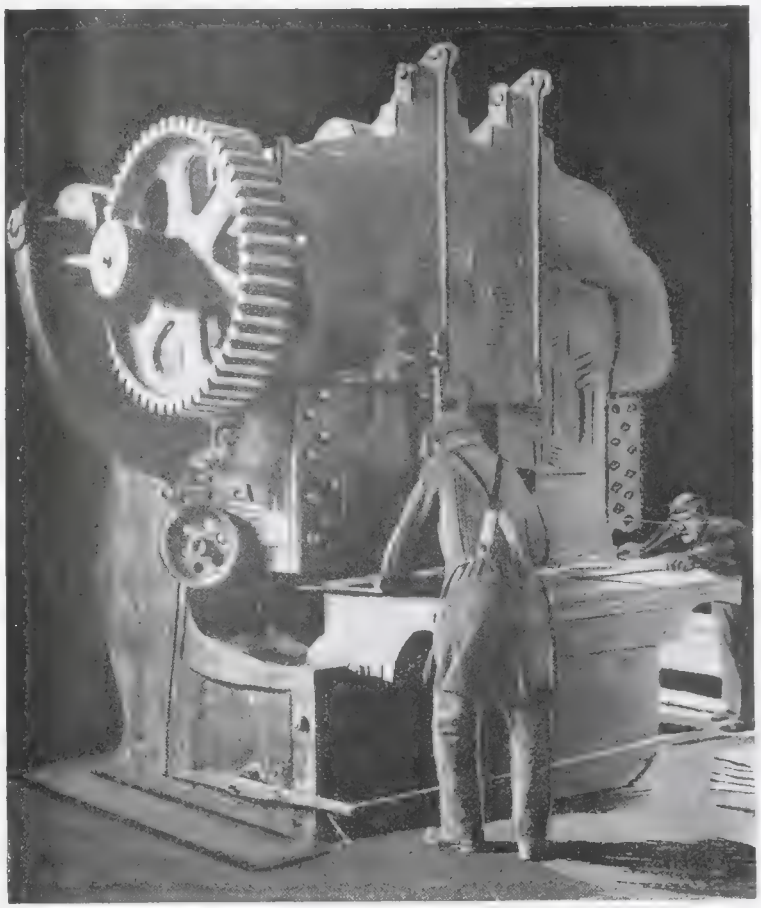

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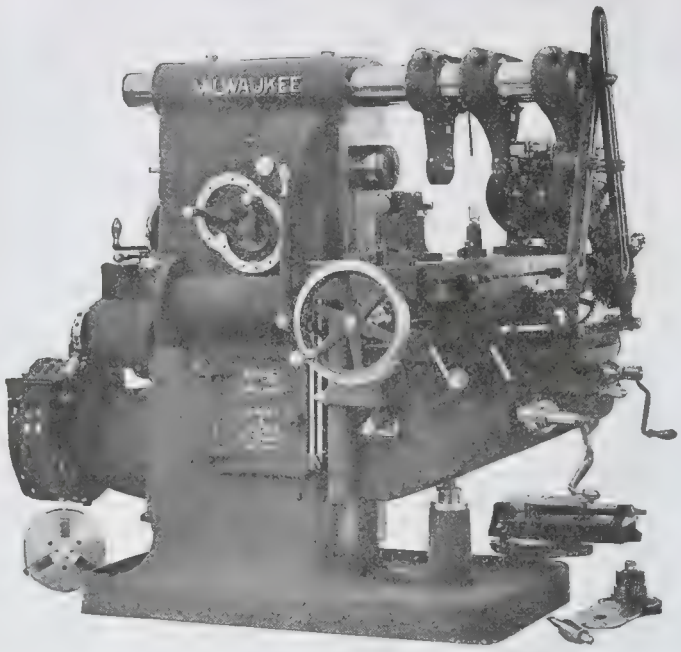
MILWAUKEE MILLING MACHINES



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Extreme r i g i d i t y, strength and accuracy are fundamental—vitally necessary in a good milling machine.

You'll find them ever present in the Milwaukee.

The Column is a one-piece box section casting with few and small openings. The base is made pan shape to catch splashing oil and chips. The dovetail of the knee slide is extended upward to the overarm for the effective affixing of attachments.

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The spindle has a large flange forged on the end. This flange carries keys for driving large face milling cutters that are attached directly to the flanged end by means of four bolts and also for driving the hardened steel arbor drive collar. The arbor drive collar protects the end of the spindle from injury, so that when face milling cutters are attached they run true. The reverse for the spindle is self-contained within the machine, no overhead apparatus being necessary.

All gears and bearings in the column and feed box are automatically flooded with lubricant that is pumped to the top of the machine and distributed by a perforated pipe, flooding downward and thoroughly lubricating the gears and bearings.

Every Milwaukee Milling Machine is equipped with a cutter lubricating system which is an integral part of the machine. This equipment was considered in the original design and is not added as a separate item. The cutter lubricating system operates only when the spindle is running.

Complete facts regarding Milwaukee Milling Machine will be found in our catalogue, which will be sent on request.

KEARNEY & TRECKER CO., Milwaukee, Wis., U.S.A.

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You have read this ad. Then find out about Chapman Bearings for your shafting hangers, pillow blocks, loose pulleys, friction clutches or wherever you employ bearings.

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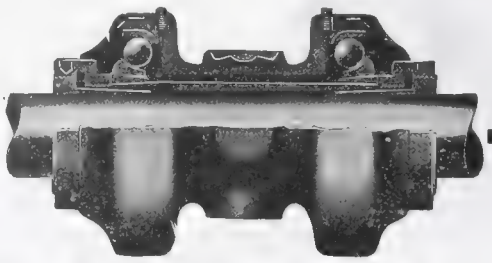
TRANSMISSION BALL BEARING CO., BUFFALO, N.Y.

They will fit your present hanger frames



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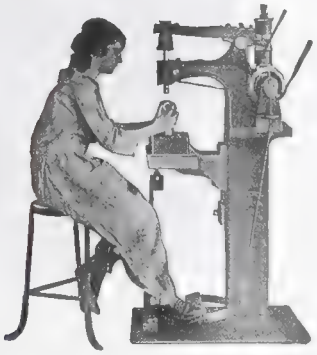

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Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3 16".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

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Let us shoulder your riveting problems.
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a medium-priced babbitt specially adapted for Saw Mill and Woodworking machinery.

Will remain cool under exceptionally high speed.

Its long life proves its efficiency.

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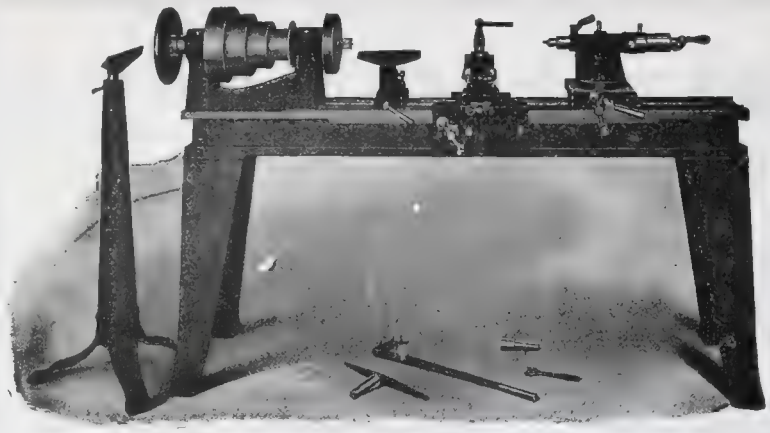

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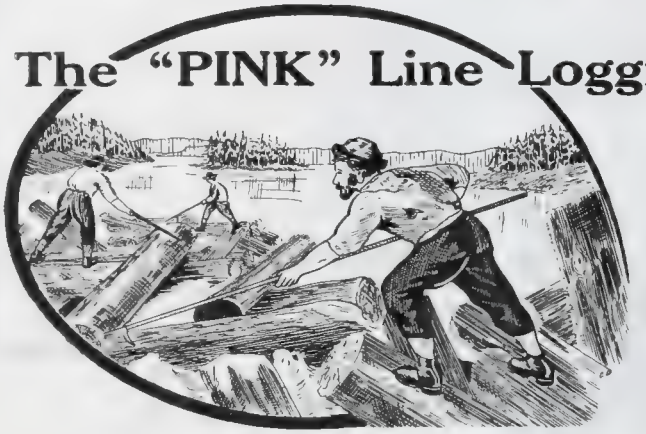

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We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

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Your money back without question if they fail to stand up.

We know

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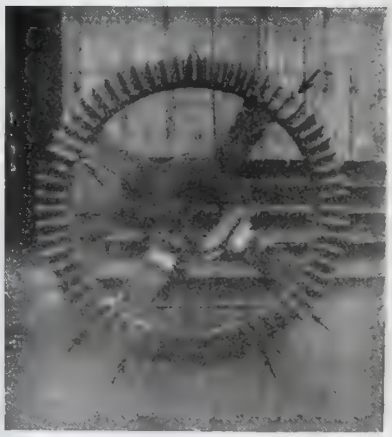

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Telephone Service : Long Distance Main 5779, and at Night Westmount 3483

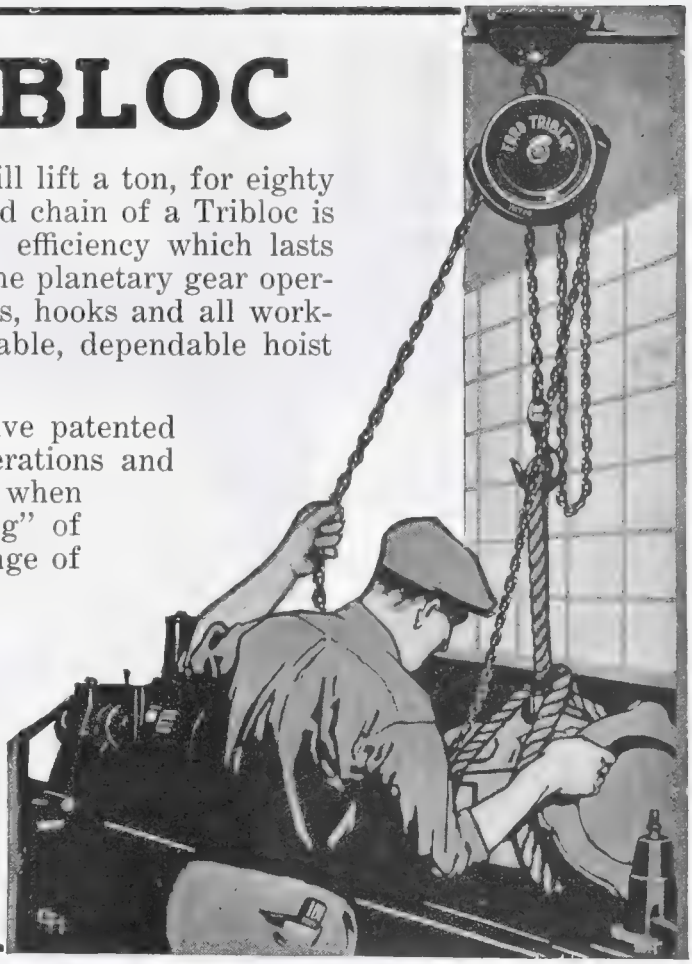
8

FORD TRIBLOC

The eighty-two pound pull of one man will lift a ton, for eighty per cent of the power applied to the hand chain of a Tribloc is converted into lifting energy—this high efficiency which lasts throughout the life of the hoist is due to the planetary gear operating mechanism with steel gears. Chains, hooks and all working parts, also are made of steel—a durable, dependable hoist construction.

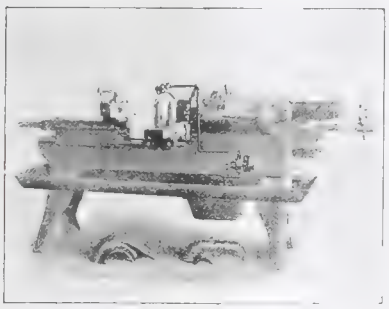
The Loop Hand Chain Guide, a distinctive patented feature, makes a Tribloc safe in all operations and saves the working parts from damage and, when working at high speed, prevents "gagging" of the hand chain and its overriding the flange of the hand wheel.

There's a 5-year guarantee with every Tribloc—in capacities of ½ to 40 tons.



Ford Chain Block & Mfg. Co.
Second and Diamond Sts., Philadelphia, Pa.
PARIS TURIN ZURICH BARCELONA
OVER SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA 120 BROADWAY, NEW YORK, U.S.A. ALMACOA
2155 D

TRAHERN LUBRICATING PUMPS



Screw Machine
W. K. Millholland Machine Co.

It does not take much reasoning to reach the conclusion that W. K. Millholland Machine Company would be very careful when selecting a pump to install on their product before its sale.

They would choose a pump which they had tried and knew to be dependable.

They would select the best type from the dozens which are being manufactured to-day.

They chose a TRAHERN, for they knew it would increase the efficiency of their machines.

A trial is all that is necessary to convince you that they are THE logical installation.

We'll stand by you--Try One

TRAHERN PUMP COMPANY
ROCKFORD, ILLINOIS
Canadian Agents:
A. R. Williams Machinery Co., Toronto, Ont., Can.

DUNBAR SPRINGS

ACCURACY ASSURED

You can always depend upon Dunbar Springs being **accurate.** Before proceeding with any order the first few springs are carefully tested and checked up for this very purpose.

Seventy-two years' experience making flat and spiral springs of every description enables us to furnish you with springs of the highest quality, that can be depended upon under all conditions.

Send blue prints for estimates.

The Dunbar Brothers Co.
BRISTOL, CONN

For Light, Accurate, Commercial Work

You will be interested in studying "Star" Lathes from the viewpoint of using the "small lathe" to a greater extent on your work. Investigate these factors: (1) Saving in flour space; (2) saving in first cost; (3) saving in power; (4) simplicity of operation.

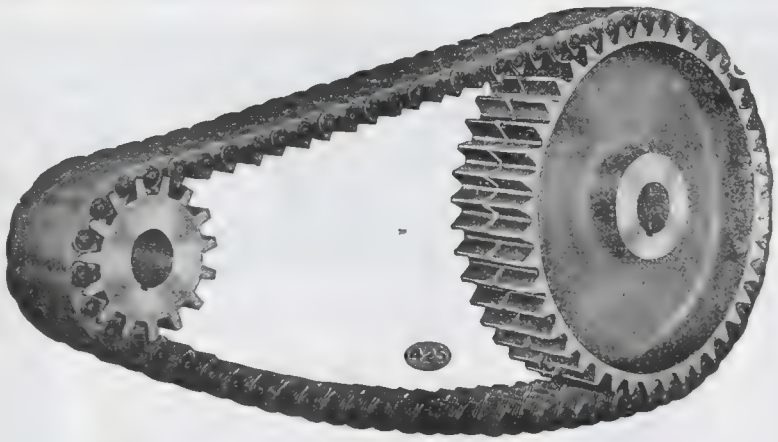
11" x 5" "STAR" Quick Change Engine Lathe

For Experimental Shops
For Manual Training

"Star" Lathes do the work of heavier, more costly equipment on light manufacturing and repair work. Accuracy is an inherent quality.

Ask for the "Star" Lathe Catalogue.

The Seneca Falls Mfg. Company, Inc.
366 W. Falls St., SENECA FALLS, N.Y.



Jones & Glassco (Reg'd)

ENGINEERS
MONTREAL AND TORONTO

Specialists in
POWER TRANSMISSION CHAINS

CANADIAN AGENTS FOR
"RENOLD"
Patent Silent and Bush Roller Chains
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Rocker Joint Silent Chains

Chain Drives from ¼ H.P. to 5000 H.P. in successful operation

Write for particulars to

Head Office:
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TORONTO

MAKE NAILS! NOT NOISE!

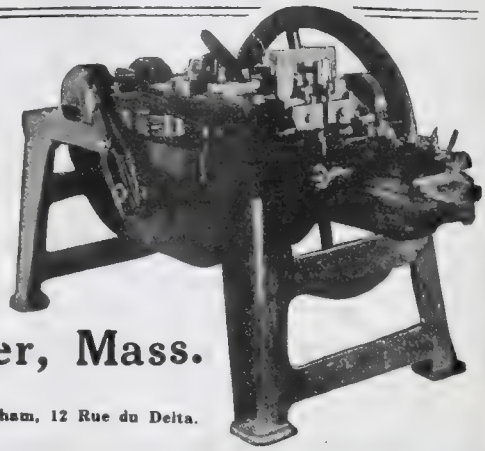
We offer the trade new types of

WIRE NAIL MACHINES

QUIET IN OPERATION; WITH VERY HIGH OUTPUT; ALL PARTS ACCESSIBLE; DECREASED MAINTENANCE COSTS; GREAT CAPACITY; OCCUPYING SMALL FLOOR SPACE.

Smoothly running machines, with balanced mechanical motions and no rotating cams. Built in 5 sizes, handling wire from No. 17 to ⅝" diam.

PRACTICALLY NOISELESS IN OPERATION



Sleeper & Hartley, Inc., Worcester, Mass.

CANADIAN BRANCH, COATICOOK, P.Q.

London, England, F. A. Perry, 63 Queen Victoria Street, E.C. 4. Paris, France, Edgar Bloxham, 12 Rue du Delta.
Australia: Edwin Wood Pty. Ltd., Melbourne.

"OLIVER" Universal Saw Bench

A Pattern Shop Machine that you can keep busy all the time

Are you considering the Oliver Universal Saw Bench in connection with your "reconstruction" plans, or are you planning to buy *several* machines, each built for *one* purpose and used for only part of the time?

Reporting on this particular Oliver Universal Saw Bench our representative says: "A veritable procession of men used it all the time. One man had a cross-sawing job; a few turns of the handwheel displaced the rip-saw, which had just been used, and he was all fixed. Operations calling, in turn, for rip-sawing, cross-sawing, joint-cutting at various angles; or the use of the angular-attachment and tilted table in combination, rapidly followed."

This machine is a complete shop in itself

Foreign Offices: Manchester, Eng. Paris, France. Rotterdam, Holland. Tokyo, Japan

OLIVER MACHINERY CO.
GRAND RAPIDS, MICH.

Have The Maritimes Had Fair Play?

THE Maritime Provinces did not enter Confederation very willingly and it may surprise people in other parts of the Dominion to learn that at the present time the people of New Brunswick and Nova Scotia are not altogether pleased with the results of the bargain. There is a distinct feeling among them that the advantages of Confederation have gone to the other Provinces. In the course of an article in the July issue of MACLEAN'S MAGAZINE, Thomas M. Fraser explains why this feeling has grown and the basis for it.

This article was written for the purpose of letting the other provinces know that the feeling exists but it will be of intense interest to people in the Maritimes. Be sure to read it—"The Spirit of the Maritimes."

"The Land of National Leaders"

An article on the political aspect of the Eastern Provinces and the achievements of their leading statesmen.

"Guarding Our Coast Line"

An extremely interesting description of the measures that were taken to patrol and guard the Atlantic seaboard during the war.

Bonar Law, the man from the Maritimes, who has been the able lieutenant of Lloyd George at all crises in Great Britain, appears on the cover in a handsome three-color reproduction.

Other Big Features of the Number

"With the Snowball Brigade"

By Captain Louis Keene

Just back from Siberia—Captain Keene tells some sensational and intensely gripping things about conditions in that country which the Canadian forces are helping to stabilize. It is a record of international complications, strange atrocities and almost unbelievable living conditions.

"The Three Tommies"

By Robert W. Service

A war poem of unusual strength.

"Solving the Problem of the Arctic"

By Vilhjalmur Stefansson

The fourth instalment of his remarkable story of the five years he spent in the north for the Canadian Government, appearing exclusively in MACLEAN'S.

Three Magnificent Stories

The best fiction obtainable is found in this issue: "Owners Up," a race horse story by W. A. Fraser; "His Majesty's Well Beloved," by Baroness Orczy; "Bunkered," by Allen C. Shore.

The Review of Reviews

Here are a few of the articles in this splendid department chosen as the best published during the past month in all magazines:

Finding Husbands For Three Million Women.
Will England Become an Agricultural Country?
Germany Can be Prosperous Under the Peace Terms.
The Woman Who Wrecked the World.
The Great Lama Rides in Motor Car.
Strange Personalities at Paris.
Making All Men Equal.
Winning the Secrets of the Desert.

Over 70,000 Canadian Families Buy

MACLEAN'S

"CANADA'S NATIONAL MAGAZINE"

JULY ISSUE *Now On Sale At All News Dealers* ***20c.***

If there are no newsdealers in your town, or if your newsdealers cannot supply you, send 20 cents for a sample copy or $2.00 for a whole year's subscription to MACLEAN'S MAGAZINE, 143-153 University Avenue, Toronto, Canada.

Personal Satisfaction

means much to the skilled artisan.

The pleasure he gets out of working with a sharp file increases his efficiency.

That is why it pays to have him turn in dull files as soon as they reach their "inefficient point."

"Famous Five" Files stay hard and sharp because they are made of good steel, accurately cut and properly hardened. Specify them when ordering.

They are:

KEARNEY & FOOT
GREAT WESTERN
AMERICAN
ARCADE
GLOBE

Made in Canada by

Dominion Foundries and Steel, Limited

Hamilton Ontario

Steel Products

Open Hearth, Basic and Acid, Electric and Alloy Steels

Castings

For Ships, Railways, Rolling Mills, Gears, Machinery and Ingots to 35 tons

Railway Specialties

Penn Couplers, Bolsters, Truck Side Frames, Draft Gears

Forgings and Billets

Heavy Ship Forgings,
Locomotive and Car Axles
Miscellaneous Forgings

Plates

Plates and Heavy Sheets to 30 inches wide, Soft and High Carbon
Automobile Plates and Sheets

Agricultural Steel

Soft Center and Solid Plow Steel, Harrow Discs, Shovel Steel, Cultivator Blades

BALL BEARINGS
and AUTOMOBILE PARTS

All standard sizes, annular and thrust bearings. Shipped from stock. Quotations on special bearings given promptly.

Automobile parts, heavy and difficult steel stampings—also heat treatment and grinding of steel a specialty.

All Sizes of Steel Balls Shipped From Stock

The Gray Ball Bearing Company, Limited

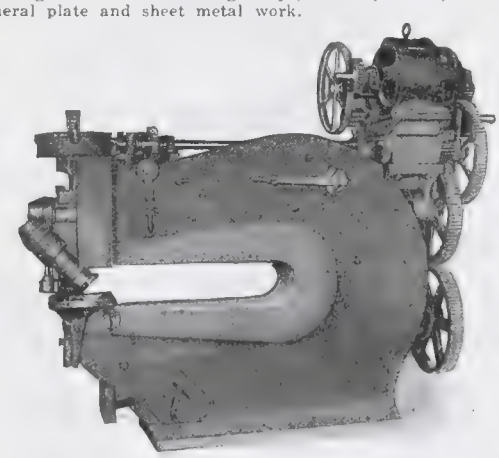
686-692 St. Clarens Avenue TORONTO, Canada

H. COLLIER SMITH
"QUICKWORK"
Registered U.S. Patent Office

ROTARY SHEARS

Made in 6 Sizes

Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square, true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.



Patented June 3rd, 1913

SAVES 50% TO 90%

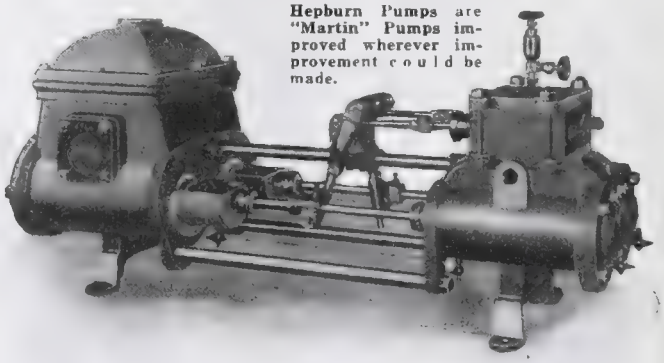
Eliminates Oxyacetylene Cutting and Plate Planing

Write for Catalogue

THE QUICKWORK COMPANY, ST. MARYS, OHIO, U. S. A.

Hepburn Pumping Machinery

Our line embraces standard duplex pumps for boiler feeding and for fire and general service; tank or low service duplex pumps; duplex hydraulic pumps for service in connection with hydraulic lifts and presses, accumulators and oil presses; pressure or mine pumps; horizontal power pumps and air and circulating pumps, etc.



Hepburn Pumps are "Martin" Pumps improved wherever improvement could be made.

JOHN T. HEPBURN, LIMITED

18-60 Van Horne Street Toronto, Ontario

OXY-ACETYLENE

Thermit and Electric Welding

BY

THE CARTER WELDING CO.

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Oldest, Best Equipped, and Most Experienced
Welding Company in Canada

WRITE US ABOUT YOUR OXYGEN SUPPLY

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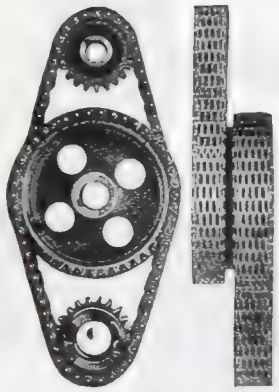


War Record Not Made Public

The "Whitney" Special Quality "Type M" Chains

made a great showing during the war years 1916-17 and 1918.

Our tests and demonstrations were made on prominent 8-cylinder motors in service on a large number of cars in the State of Connecticut.

During this long period not a single "Whitney" Chain or Sprocket had to be replaced and the condition of every Drive has been pronounced remarkable.

One Drive recently examined had given over 35,000 miles' service and both Chains and Sprockets were in such perfect condition that they appeared good for more than double that record (Sprockets having no adjustment).

The links of this SPECIAL CHAIN have finished faces and reamed holes, and the smooth faces do not damage the Sprocket teeth.

Our war contracts were such that we did not announce this SPECIAL CHAIN until after the conflict was over.

THE WHITNEY MFG. CO.,
Hartford, Connecticut

The Largest Selling Quality Pencil in the World

VENUS PENCILS

IN the office, for jotting down your brain picture of a new machine—and in the drafting room, for carrying out its details with undeviating accuracy, you will find the superb VENUS Pencils dependable, perfect tools.

17 black degrees and 3 copying

For bold heavy lines
6B-5B-4B-3-B

For general writing and sketching
2B-B-HB-F-B

For clean fine lines
2H-3H-4H-5H-6H

For delicate thin lines maps
7H-8H-9H

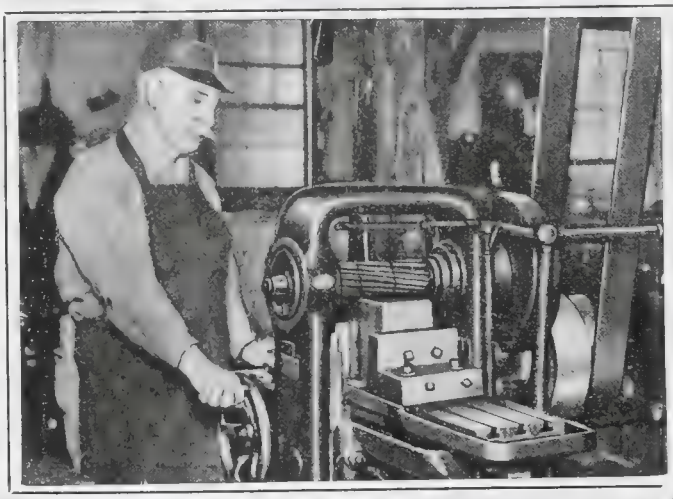
SPECIAL 14c OFFER

Send 14 cents for 3 trial samples, stating degree. After you find your perfect VENUS Pencil, order them at your dealer.

American Lead Pencil Co.
238 Fifth Avenue, New York
and Clapham, London, Eng.

BRIGGS MILLER

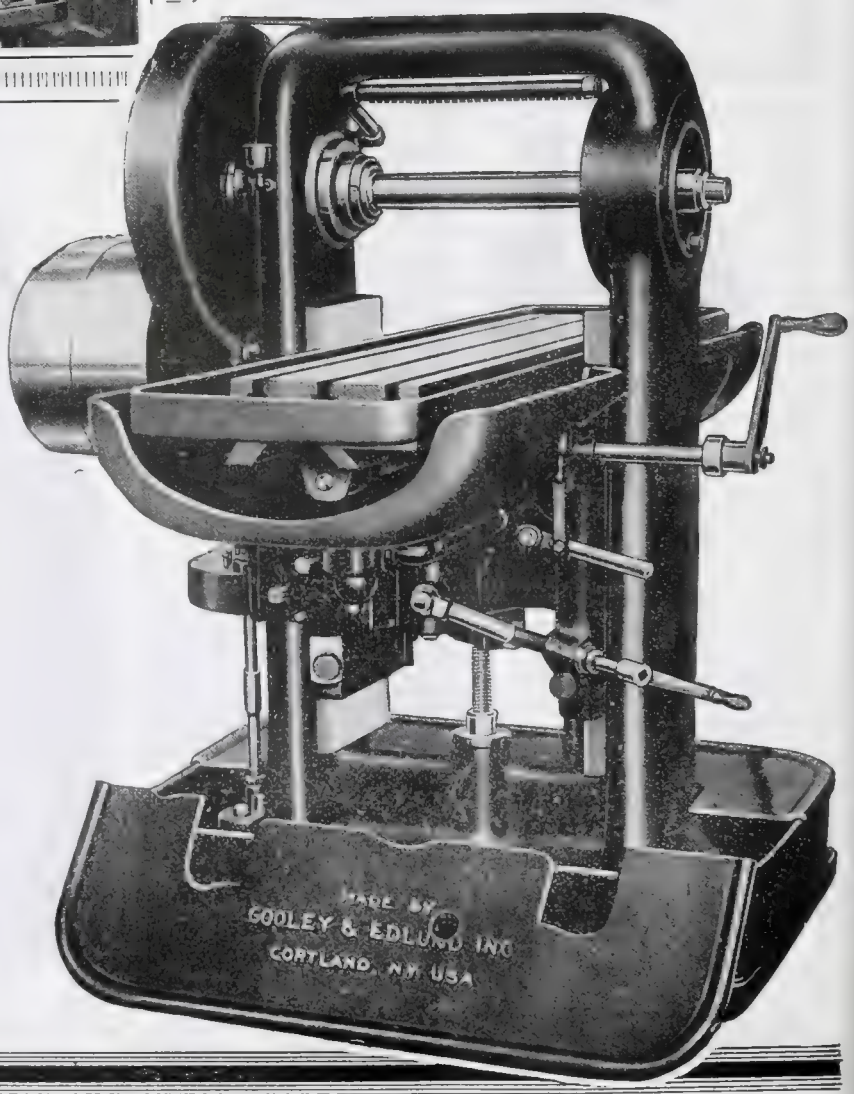
Keeps Five Die Sinkers Going



HERE you see the Briggs Miller Squaring Die Blocks, and it is working so fast it keeps five die sinkers going.

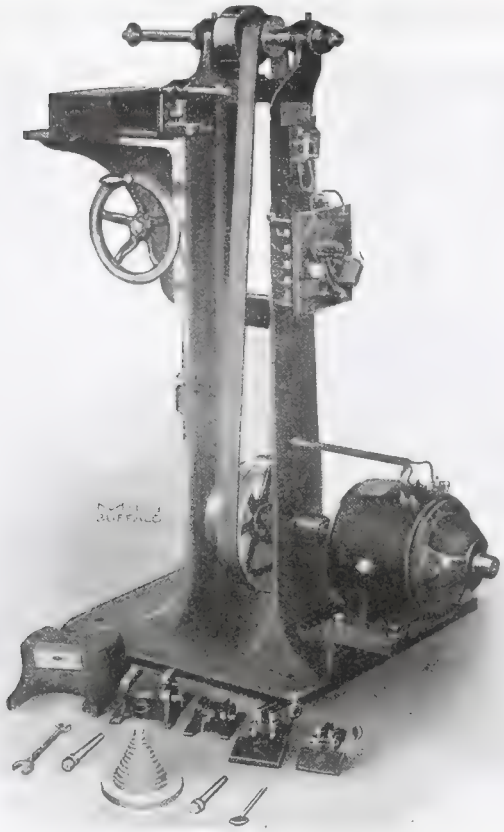
Some are new, squared from the rough; some are old, annealed, cut down and made over; some are oblong, some square, in sizes up to 9 inches. This Briggs Miller has been squaring blocks for four years; has never given any trouble. When cutters get dull the operator has another gang ready to go on with the work. Unusual rigidity accounts for Briggs' higher efficiency.

Don't you think you could use this tool to advantage in your shop? Write for the details.



Gooley & Edlund, Inc.
Cortland, N.Y., U.S.A.

Garlock Walker Machinery Co., Ltd.
Toronto, Ont.
Williams & Wilson, Ltd., Montreal



The "MODERN" Die Chaser Grinder

Let Your Die Troubles End Right Here

Why let Die Trouble stand between you and maximum production?
In the

Modern Die Chaser Grinder

you will have a machine that does away with die trouble—because its output is **marvellously eccentric.**

Made for belt drive or a complete motor-driven unit. Special attachments for grinding Spring Dies, Pipe Dies, Reamers, Taps, Hobs, Spiral and End Mills, Milling Cutters, etc.; can be furnished with the regular equipment.

For Fast Accurate Work

Bulletin C. G. will give you full details. We would also be pleased to send you full particulars re **"Modern" Self-Contained Grinding Machines.** Tools splendidly adapted to meet the present demand for large production.

Modern Tool Company

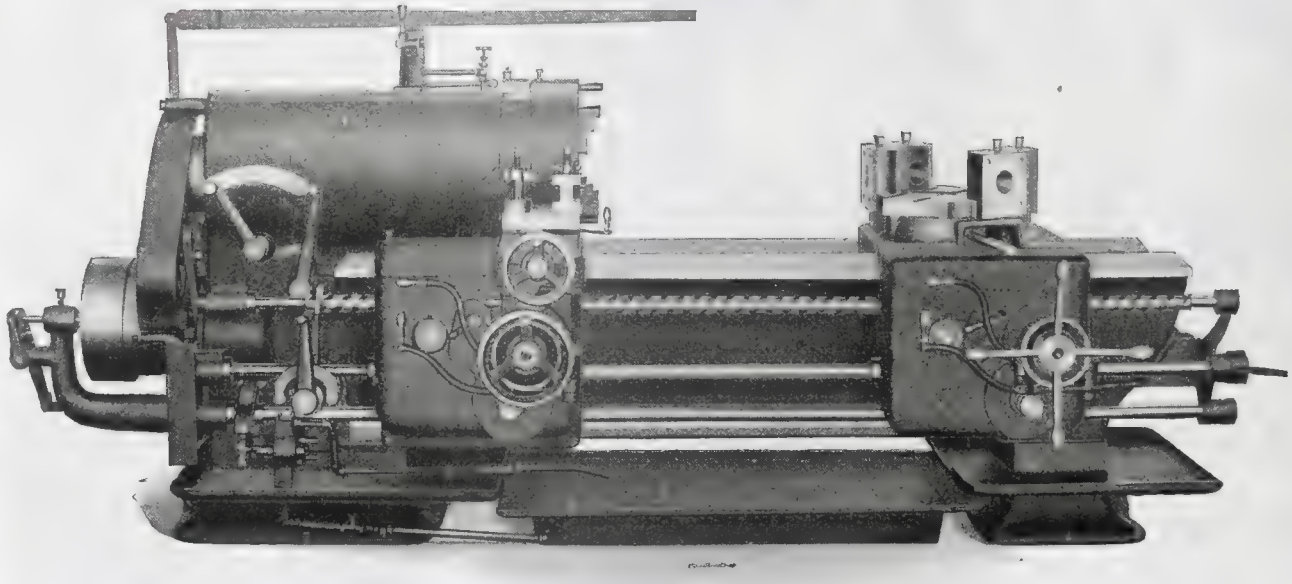
Main Office and Works: State and Peach Streets, Erie, Pa., U.S.A

Canadian Agents: Rudel Machinery Co., Toronto and Montreal

New York Office: - 50 Church Street
Chicago Office: - 32 N. Clinton Street

F. Wesley Parker, Resident Engineer and Export Agent, 2 Rector Street

STEINLE



Another reason why the Steinle 24" Full Swing Side Carriage Turret Lathe is ahead of all others in the economical and accurate production of many classes of work.

The Massive High Powered Quick Change Speed Headstock

The headstock housing is cast integral with the bed, this design insuring rigidity and permanence of alignment. This headstock is of box section entirely closed on front, top and bottom and also on the back with the exception of an opening left for assembling purposes and for which a suitable cover is provided. This design and the distribution of metal are arranged with a view of securing rigidity and also with the idea of absorbing all vibration due to heavy wide faced cuts and shock or jar incidental to intermittent or uneven cuts, all of which it successfully accomplishes. The thirty spindle speeds are substantially divided into three groups as follows:

First train of gearing: 10 spindle speeds corresponding to open belt speeds.

Second train of gearing: 10 spindle speeds corresponding to back gear speeds.

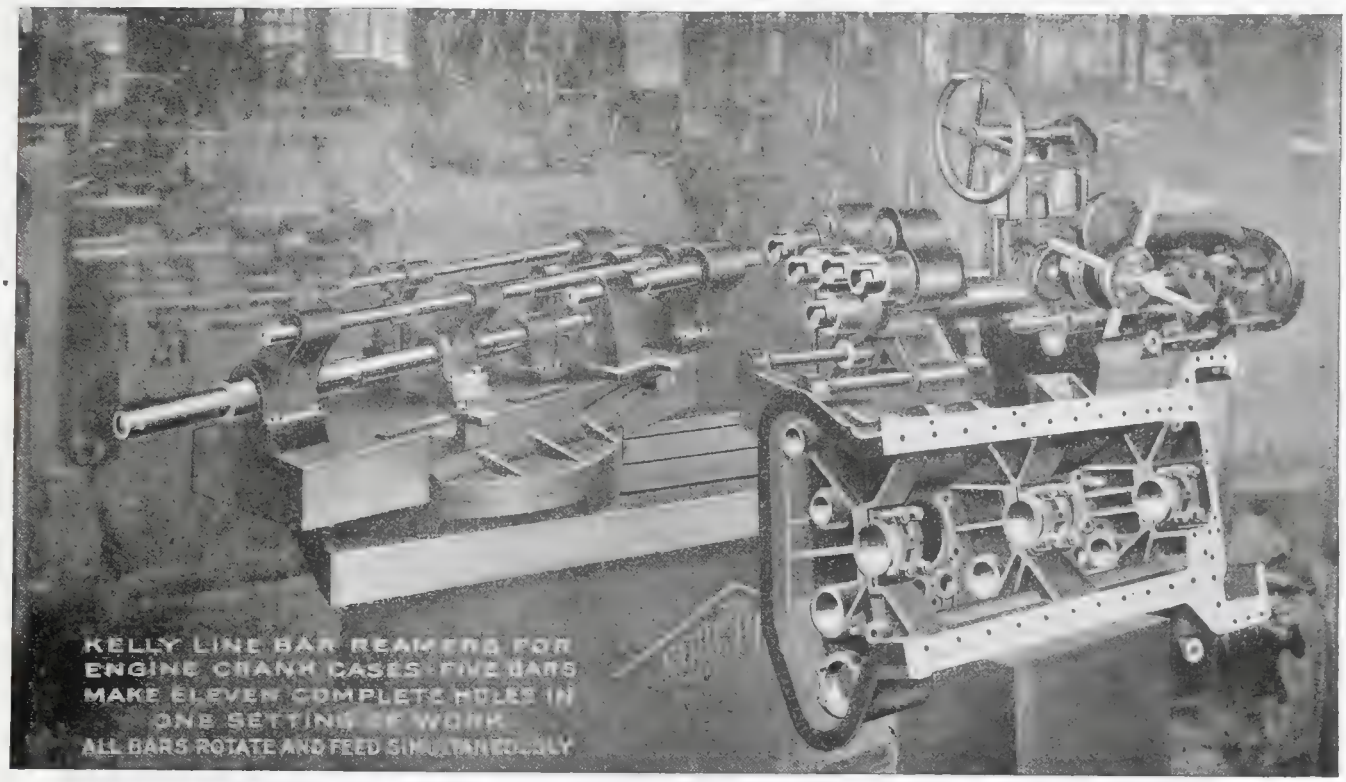
Third train of gearing: 10 spindle speeds corresponding to face gear or triple gear ratio. In reality the first train is back geared; the second double back geared; and the third quadruple geared. All of these gear ratios are high, resulting in great leverage in the application of power to the spindle. The utmost of power consumed in transmission is small, almost negligible in fact, with the result that the machine can be operated at very low power cost, the same amount of power being delivered to the spindle at all speeds but varying in the amount of torque according to the different gear ratios, the amount of torque increasing with the corresponding decrease in spindle speed.

All gear ratios and speed changes are controlled by conveniently located levers.

There are more good reasons why the Steinle 24" Full Swing Side Carriage Turret Lathe is ahead of all others in the economical and accurate production of many classes of work. We will give these reasons in future advertisements in this journal. Watch for them. They will be interesting to you.

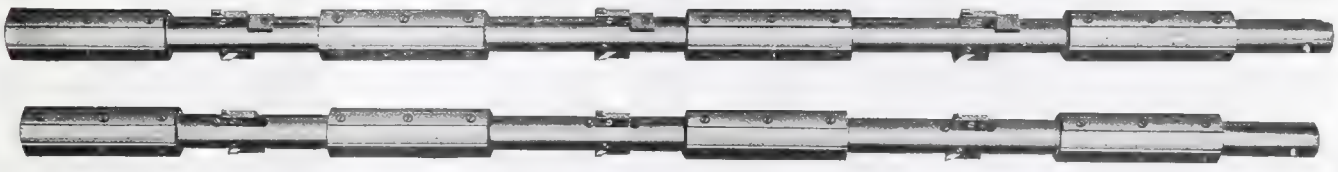
STEINLE TURRET MACHINE CO.

MADISON - - WISCONSIN, U.S.A.


KELLY LINE BAR REAMERS FOR
ENGINE CRANK CASES. FIVE BARS
MAKE ELEVEN COMPLETE HOLES IN
ONE SETTING OF WORK.
ALL BARS ROTATE AND FEED SIMULTANEOUSLY

KELLY PRODUCTION TOOLS

LINE BORING AND REAMING BARS



INTERCHANGEABLE REAMERS ADJUSTABLE-REPLACEABLE BLADES

KELLY SERVICE

all combine to make KELLY tools the RIGHT tools for your work.

Deliveries 1 to 10 days. *Send for our Catalog J-4*

THE KELLY REAMER COMPANY

Cleveland, Ohio, U.S.A.

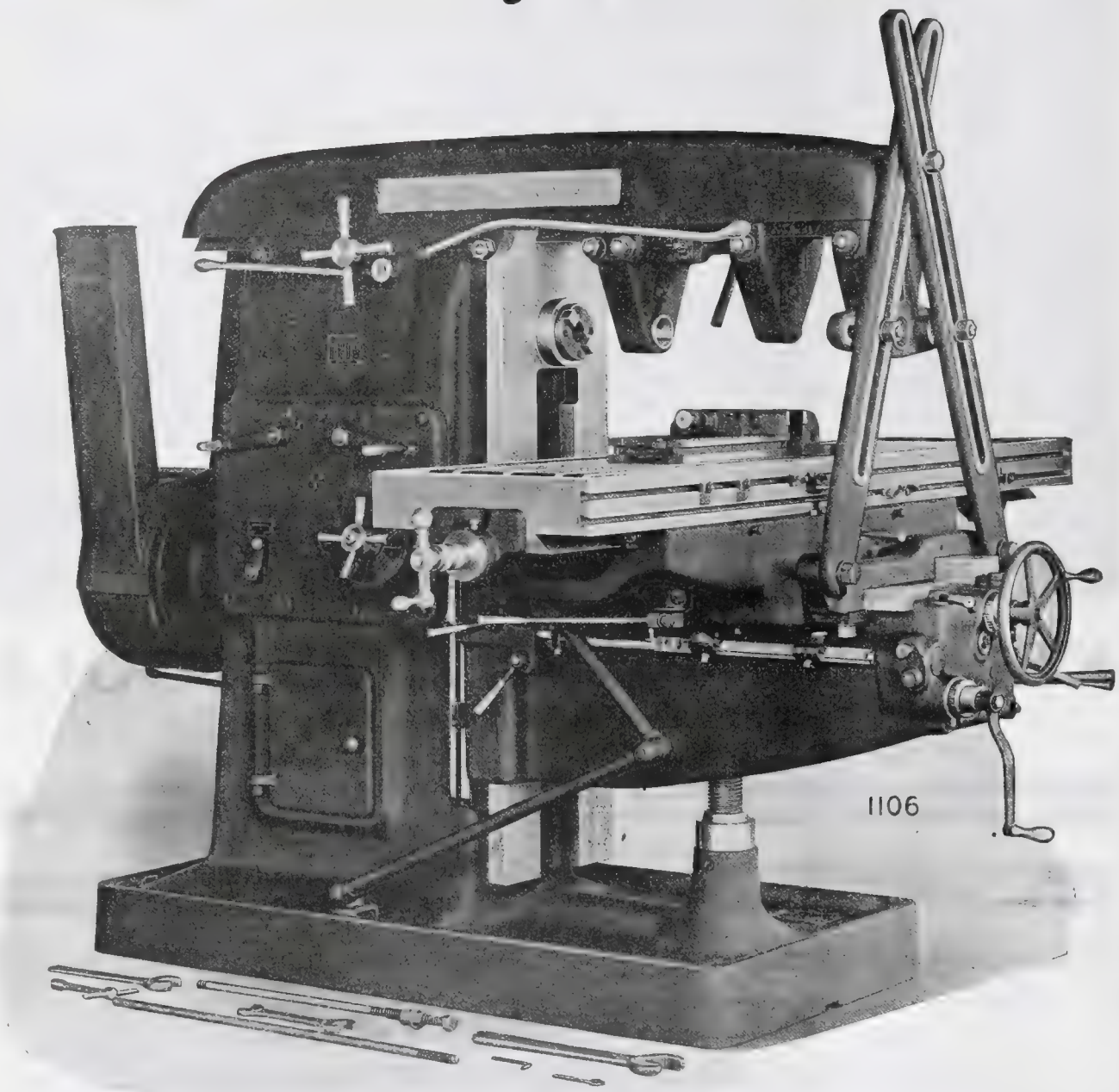
AGENTS

Forty Domestic Agents

WINNIPEG: **Canadian Fairbanks-Morse Co.**

London: Burton, Griffiths & Co., Ltd. Paris: Burton Fils. Stockholm: G. A. Galco, Ltd.
Latin America: Fox Bros. & Co., New York City

An Entirely New Miller



"The Cincinnati No 5."

Sixteen Big Productive Features

Intermittent Feed with Power Quick Traverse, Rectangular Overarm, Square Gibbed Narrow Guides, Feed Changes made in Front of Machine, Individual Feed Control Levers at Front of Machine, Individual Feed Control Levers at Side of Machine for Control from behind the Table. Automatic Lubrication for Mechanism in Column, Centralized Oiling for other Mechanism, six Stations, Stream Lubrication for Cutters and Work, Sliding Gears for Speed and Feed Changes, Safety Couplings for both Feed and Quick Traverse, Main Starting Lever, Controlled from Front or Rear, Automatic Brake for Spindle Stop, Cincinnati Flanged Spindle End, No. 14 Taper Hole in Spindle for large Arbors, Spindle Reverse in Machine.

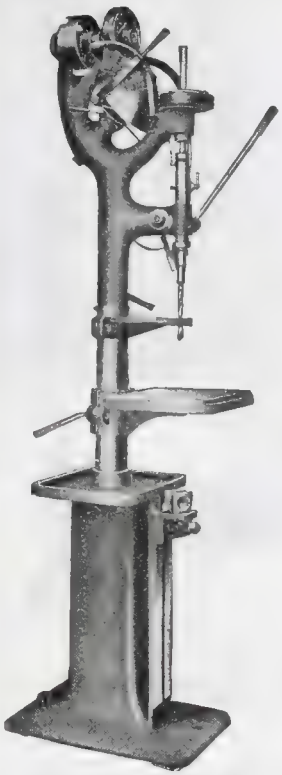
The Cincinnati Milling Machine Company

CINCINNATI, OHIO

Canadian Agents:

H. W. Petrie, Ltd. - - - Toronto, Ont.
Taylor Engineering Co., Ltd. - Vancouver, B.C.
H. W. Petrie, of Montreal, Ltd., Montreal, Que.
General Supply Co., of Canada - Winnipeg, Man.

Albany 12" Tool Room Drill



A real time saver in drilling holes up to ½ inch, because—

Patented friction drive furnishes 10 spindle speeds, from 205 to 2140 r.p.m., which are instantly available.

The operator can drill at full speed to the finish, saving time on every hole. Micrometer gauge shows exact depth of drill at all times, and the spindle may be stopped — or started—almost instantly.

The average operator can use this drill with the facility and accuracy of an expert.

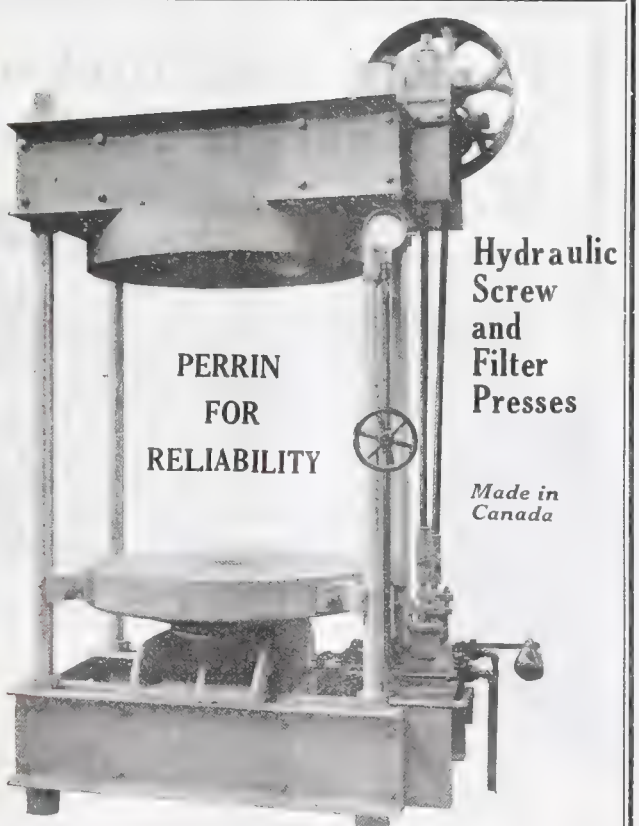
Splendidly built; has special ball bearing transmission, chucks and drills quickly changed.

Details in Circular.

FOREIGN AGENTS: F. W. Horne & Co., Tokyo, Japan, China, Korea. R. L. Scrutton Co., Ltd., Sydney, Australia and New Zealand. Litton's Machine Tool Co., London, England. A. Berthoin, Grenoble, France. V. Lowner, Copenhagen, Denmark. Aktiebolaget, Rylander, Asplund, Stockholm, Sweden. Gillespie Bros. & Co., South Africa (New York City). Monti & Oscuro, Milan, Italy.

Want description of this ideal tool room drill

Albany Hardware Specialty Mfg. Co.
ALBANY, WISCONSIN



PERRIN FOR RELIABILITY

Hydraulic Screw and Filter Presses

Made in Canada

Hydraulic Truck Tire Press

WILLIAM PERRIN LIMITED
TORONTO

Your Money's Worth

Never again will the Canadian Nation and People be the same careless improvident spenders of "ante bellum" days. "EFFICIENCY" and "GET YOUR MONEY'S WORTH" will be the popular motto and the successful machine shop manager must be able to see the advantage of making one pound of High Speed Tool Steel do the same work as ten pounds in forged tools; in other words he must and will

USE ARMSTRONG TOOL HOLDERS

No heavy "stub-ends" to throw away. No time lost with men at the grinder while lathes stand idle. No stock of heavy sizes of steel to carry, and the blacksmith as a tool-dresser is eliminated entirely.

Armstrong Tools are great favorites with the men—a good thing to consider from a production standpoint.

Our Catalogue is of handy pocket size and will be mailed to you upon request

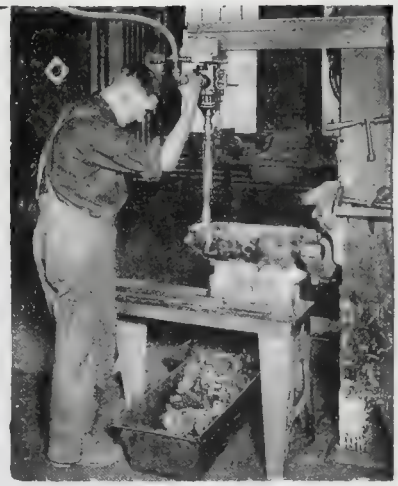
STRONG **ARMSTRONG BROS. TOOL CO.** STRONG
"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.

Thor

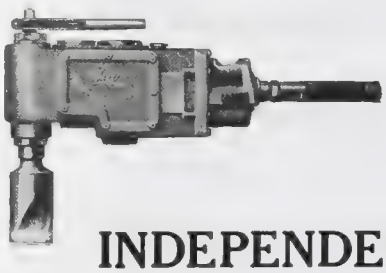
Pneumatic DRILLS and Hammers

There is a Thor Tool made especially for your work. Try it—and watch it save you time and labor and increase your production.

Thor are the only air drills made in America having Corliss valves, roller bearings, and one-piece pressed Vanadium steel connecting rods. Also equipped with telescopic screw-feed and removable crank chamber plate.



No. 32-L Reversible Compound Piston Air Drill driving ⅜-inch studs in Motor Crank cases.



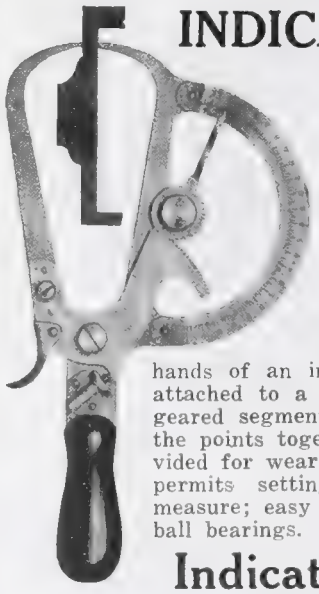
For full particulars write—

Twenty years of knowing how built into each Thor Tool you buy.

INDEPENDENT PNEUMATIC TOOL COMPANY

334 St. James St., Montreal, Que.

Toronto: 32 Front St. W. **Winnipeg: 123 Bannatyne Ave. E.** **Vancouver: 1142 Homer St.**



INDICATING CALIPERS

This finely made tool, of the simplest construction, incorporating features of outside calipers, rule, magnifier, and indicator, is accurate, easily read and manipulated with one hand. Great saving of time is effected in the hands of an interested user. A hand attached to a pinion is actuated by a geared segment; a coiled spring draws the points together; adjustment is provided for wear of parts; locking device permits setting of tool to required measure; easy movement is effected by ball bearings.

Indicating Calipers

are used by

MACHINISTS, PATTERN, TOOL and MODEL MAKERS.

$8.75 **3"** Graduated in 64th inches, Scale enlarges two times. **2"** Graduated in 100ths inches. Scale enlarges three times.

Write for folder or make inquiries thru local dealer.

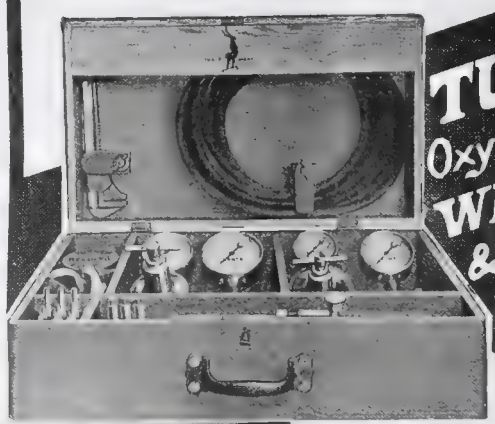
MADE EXCLUSIVELY BY THE

INDICATING CALIPERS CO.

506 East 19th St., New York

Stocked by Exclusive Canadian Agents:
Williams & Wilson Limited, 84 Inspector Street, Montreal, Que.

For Repairing Broken Machinery or Tools of Medium Size



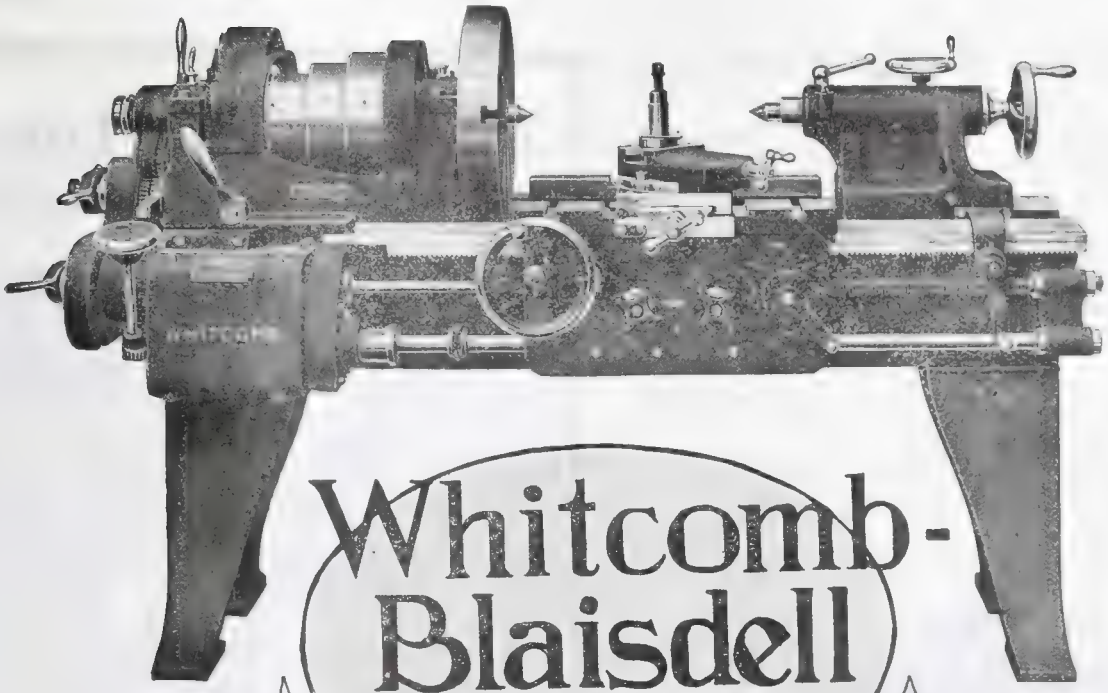
TURNER Oxy-Acetylene WELDING & CUTTING Equipment

These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

For full particulars write

The Turner Brass Works

SYCAMORE, ILLINOIS, U.S.A.



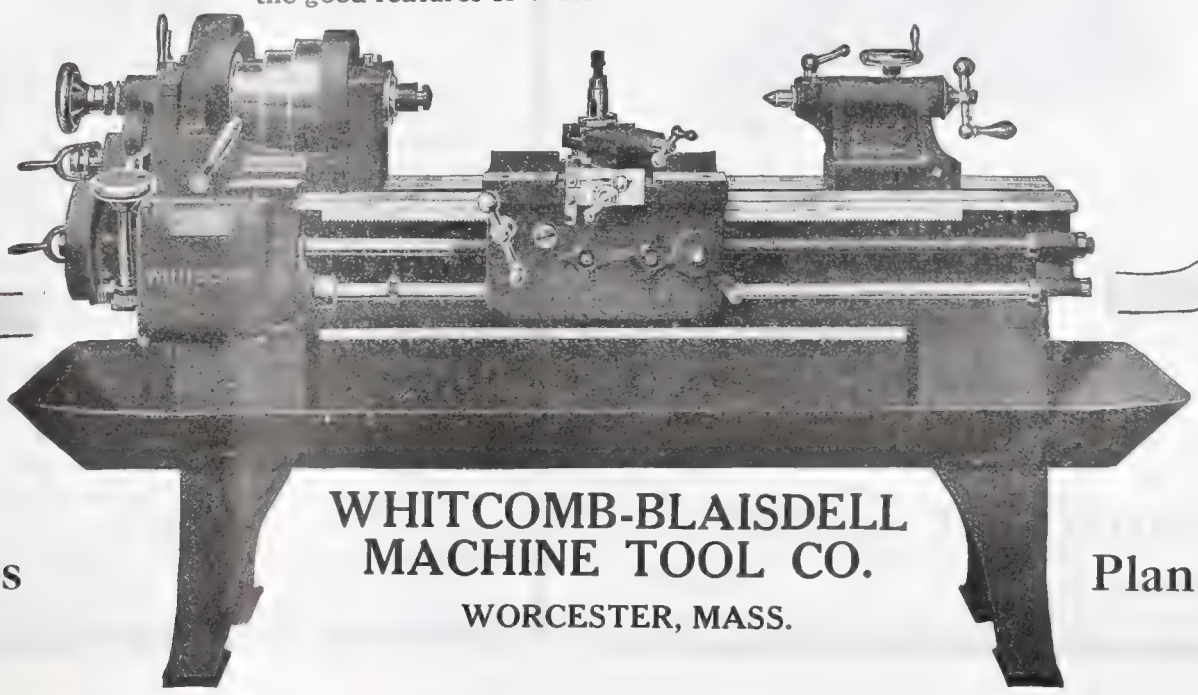
Whitcomb-Blaisdell Lathes

POWERFUL, WELL-BALANCED MACHINES THAT ARE LIGHT-RUNNING AND ADAPTED TO ALL CLASSES OF **RAPID MANUFACTURING.**

Every feature of the W-B Lathe of to-day has been considered from the viewpoint of greatest utility. Materials used embody toughness and durability. Our tests must prove great wearing quality and strength before any material is selected.

The product of an organization that has for sixty years been distinguished for the superior design, workmanship and material of its product.

Write for our latest catalog describing all of the good features of Whitcomb-Blaisdell Lathes.



Lathes

WHITCOMB-BLAISDELL MACHINE TOOL CO.

WORCESTER, MASS.

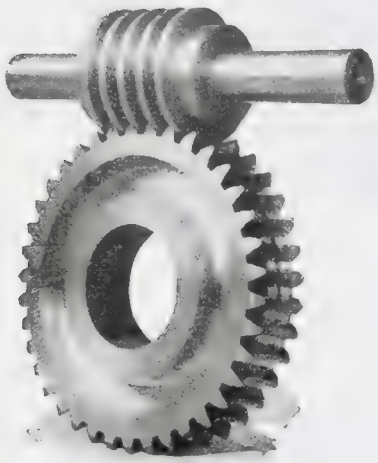
Planers

CUT GEARS

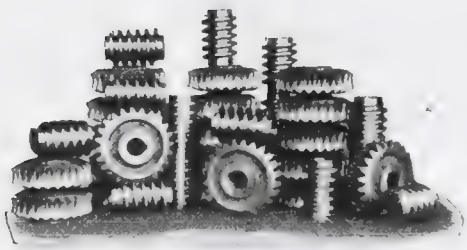
CUT GEARS

Worms and Worm Gears

Large Sizes or Small



WORM GEARS



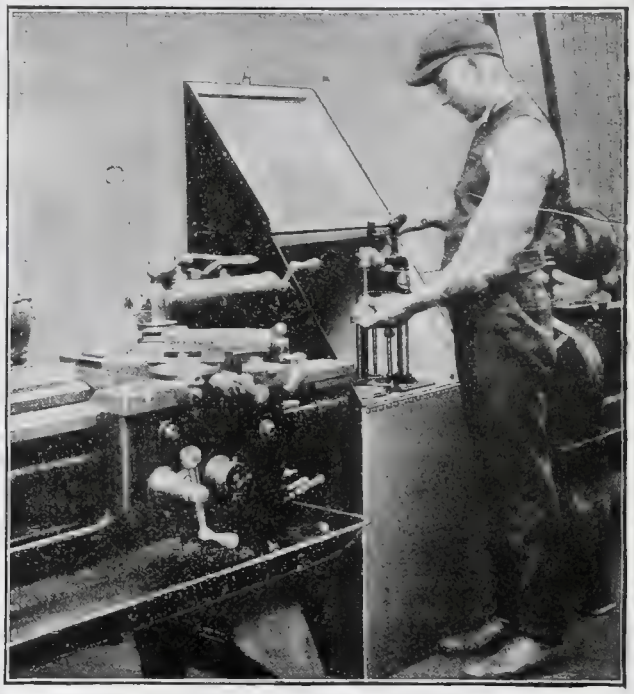
Cut Accurately
by Experts

Get Our Quotations

Hamilton Gear Co. Ltd.

Van Horne Street TORONTO

Prevent Idle Time
of Men and Machines



By placing Bowser Lubricating Oil Cabinets in departments where oil is used.

There is no going back and forth to the oil room, no spilling, no wasted oil, no fire risk from the oil storage.

Save the Oil

The oil supply can be stored and handled as systematically as raw materials or finished parts—income checked, distribution measured, charged and recorded.

Write for literature, explaining why and how Bowser Systems pay for themselves, many times over in saving of oils and labor.

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66-68 Frazer Ave., TORONTO, ONT.

Sales Offices In All Centers Representatives Everywhere

LONDON
32 Victoria St. S W 1

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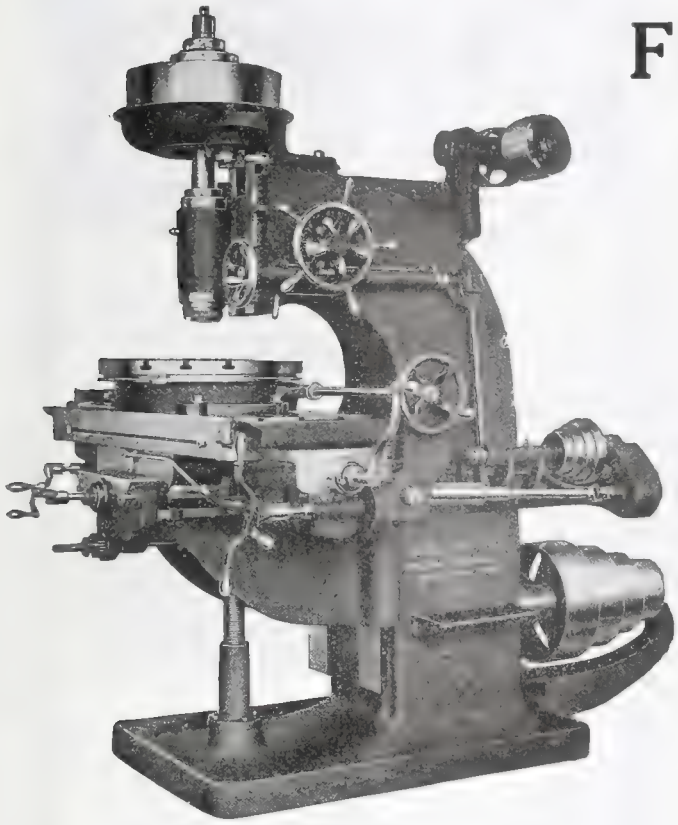
BECKER Belt Driven MILLERS

FOR PRODUCTION



"THE MACHINE
THAT GIVES THE
SMOOTH FINISH"

MODEL 6

BECAUSE:

The table is rigidly supported throughout its entire working length, keeping the work permanently aligned with the spindle.

The Becker Internal Belt Drive displaces the transmission gears with their attendant, destructive vibrations and by forming an elastic drive to the spindle, prolongs the life of the cutter through elimination of chatter. This gives the smooth finish for which the Becker is famous.

The stringent code of tests, through which every Becker machine must pass, insures perfection through perfectly made parts accurately assembled.

For accuracy, economy and productive ability, specify Becker Belt Driven Millers.

BECKER MILLING MACHINE CO.

DETROIT HYDE PARK, BOSTON, MASS. INDIANAPOLIS

Canadian Agents:

A. R. Williams Machinery Company, Limited - 64 Front Street West, Toronto
Rudel-Belnap Machinery Company, Limited - 137 McGill Street, Montreal

Oxy-Acetylene Welding and Cutting

Strength and Neatness in Manufacturing and Repairing

This illustration shows a Prest-O-Lite operator welding parts in the factory of the Packard Motor Car Co., where neatness and strength are essential.

The Prest-O-Lite Process of Oxy-Acetylene welding has been adopted as standard practice in thousands of factories, mines, machine shops and shipbuilding plants, both in Canada and the States. In the production end, this process results in increased strength with reduced weight in vital parts, while effecting substantial savings in cost.

Prest-O-Lite PROCESS

is not limited to production work. Its value in repairing is universally acknowledged. Worn and broken metal parts are quickly reclaimed and put back into useful service, avoiding costly tie-ups and delays. The actual saving on one Prest-O-Lite repair often more than pays for the entire welding outfit.

The Prest-O-Lite Process employs both gases (acetylene and oxygen) in portable cylinders. Prest-O-Lite Dissolved Acetylene (ready to use) is backed by Prest-O-Lite Service, which insures prompt exchange of full cylinders for empty ones. Provides dry, purified gas, insuring better welds, quicker work and lower operating cost.

Manufacturers, mining and production engineers will find our welding literature full of valuable data and helpful suggestions. It may help *you* to reduce your costs and improve your methods. Write for it *to-day*.

Address Dept. C-106

Prest-O-Lite Company of Canada, Limited

PREST-O-LITE BUILDING
Corner Elm Street and Centre Avenue
TORONTO

Plants: Toronto, Ont., Merritton, Ont.
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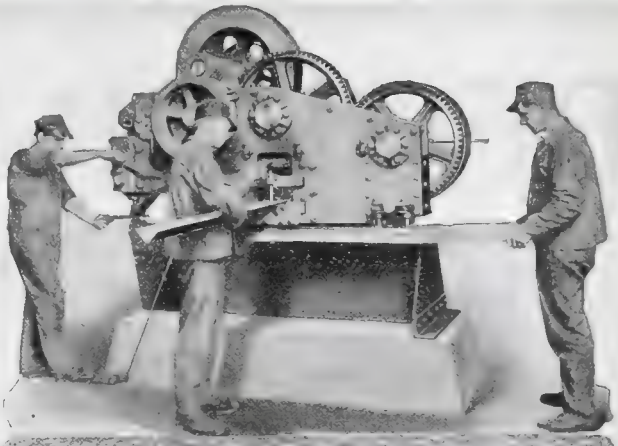
World's Largest Makers of Dissolved Acetylene



Canadian "Universals"

CANADIAN Universal Slitting Shears, Punches and Bar-Cutters are seven and one-half times as strong as cast iron and only one-third as heavy, for the same capacity.

That's why Uncle Sam used these machines so extensively during the war—that's why they should prove equally popular as a Peace Time manufacturing investment.

They will perform three separate operations at one time—slit plates, punch and cut angles, flats, squares or rounds.

Write for Catalog 325-16.

Canadian Blower & Forge Company, Ltd.

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Toronto—220 King St. W.
Montreal—57 Canada Life Bldg.
Calgary—Metals Limited.
Vancouver—Canadian Fairbanks-Morse Co.
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"Canadian"

Manufacturing Opportunities

A large plant idle since shell making stopped, for sale at a very low price. Can be utilized for many lines of manufacture. : : :

TOTAL FLOOR SPACE 109,500 SQ. FT.

TOTAL AREA OF PROPERTY NINE ACRES

This large plant, consisting of three separate buildings, approximately 1,000 ft. long, with a width of from 50 to 140 ft., has a floor space of about 109,500 sq. ft., and with an area of nine acres gives ample room for storage or expansion. Railway running across the property. Building in foreground of above cut built in 1918—frame construction—contains 85,000 sq. ft.; building in centre, built in 1909—brick construction—built for a stove foundry—has a cupola—contains 18,380 sq. ft.; building in background built in 1916—frame construction—contains 5,520 sq. ft. These three buildings can be used separately, each for a different line of manufacture. Price for entire property, $50,000.00.

The Town of Pembroke is situated at the junction of the Ottawa and Muskrat Rivers, and is favorably located between the East and the West, being on the main line of three transcontinental railways; has good water supply, good homes, good schools.

Unlimited Hydro-Electric power obtainable at very low rates. There is a plenitude of labor available, both male and female. An unrivalled opportunity for an industry to start up with a small outlay.

For further particulars and plan of buildings, apply to

Pembroke Iron Works, Limited - Pembroke, Ont.

Cuts Costs Increases Production ---*it is a Rockford Machine*

This powerful machine is made to drive high-speed drills up to 3″ diameter, for drilling and boring tools up to 8″ in diameter, for boring out cored holes in cast iron.

It has a lateral and vertical adjustment of the head that permits the spindle to operate anywhere on a surface 18″ high by 36″ wide.

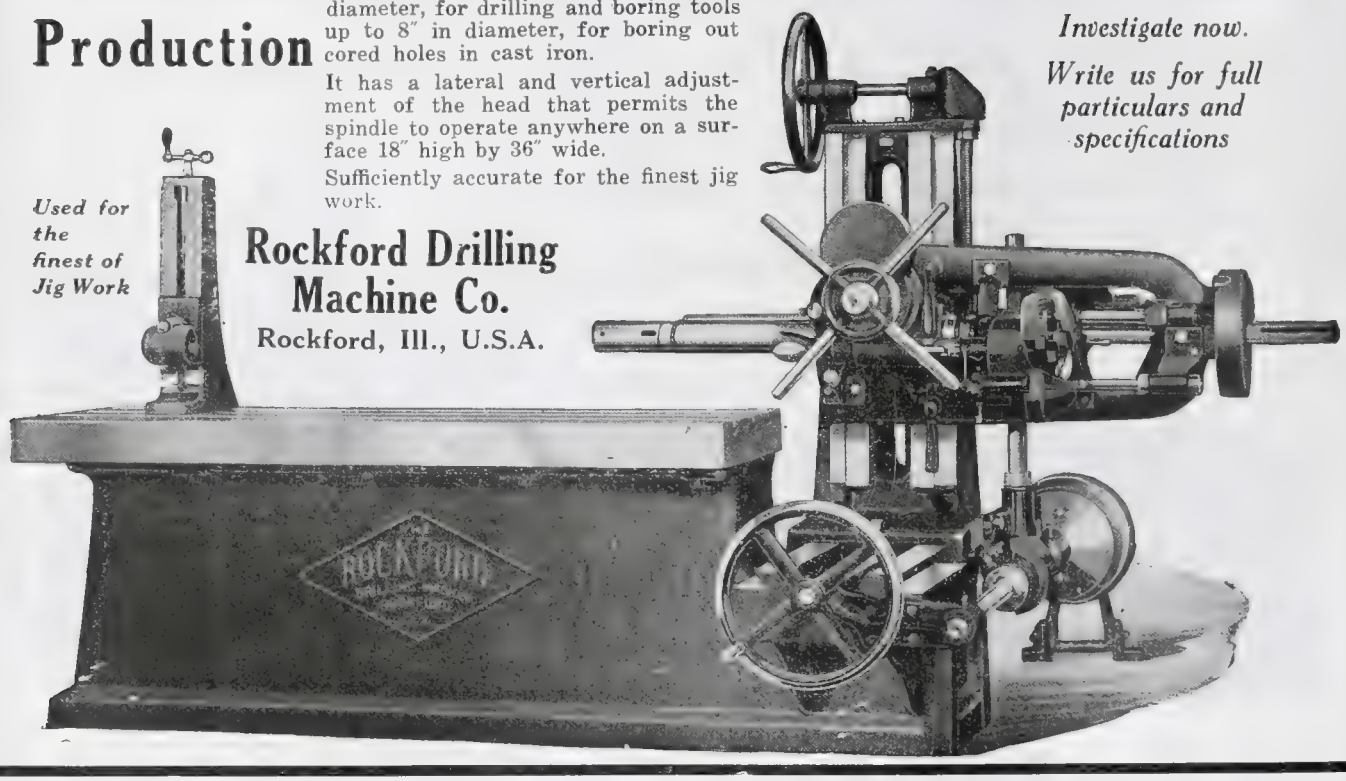
Sufficiently accurate for the finest jig work.

Investigate now.

Write us for full particulars and specifications

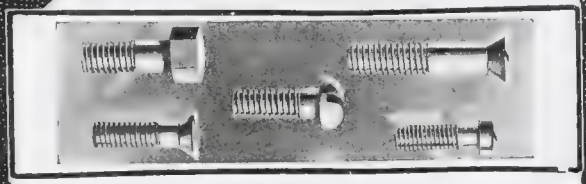
Used for the finest of Jig Work

Rockford Drilling Machine Co.
Rockford, Ill., U.S.A.



Wood Screw Making Machinery

SEND FOR CATALOGUE
Series B6



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

Cable address: "Cook,"
Hartford, U.S.A.
Codes: Liebers
Western Union

Asa S. Cook Co.
Hartford, Conn.

Every Emery Wheel With Its Own Dresser

Desirable, isn't it, now that cost is no objection? For with an inexpensive Desmond-Stephan Dresser for every wheel, every wheel will be touched up frequently and so kept true and equal to its original cutting efficiency.

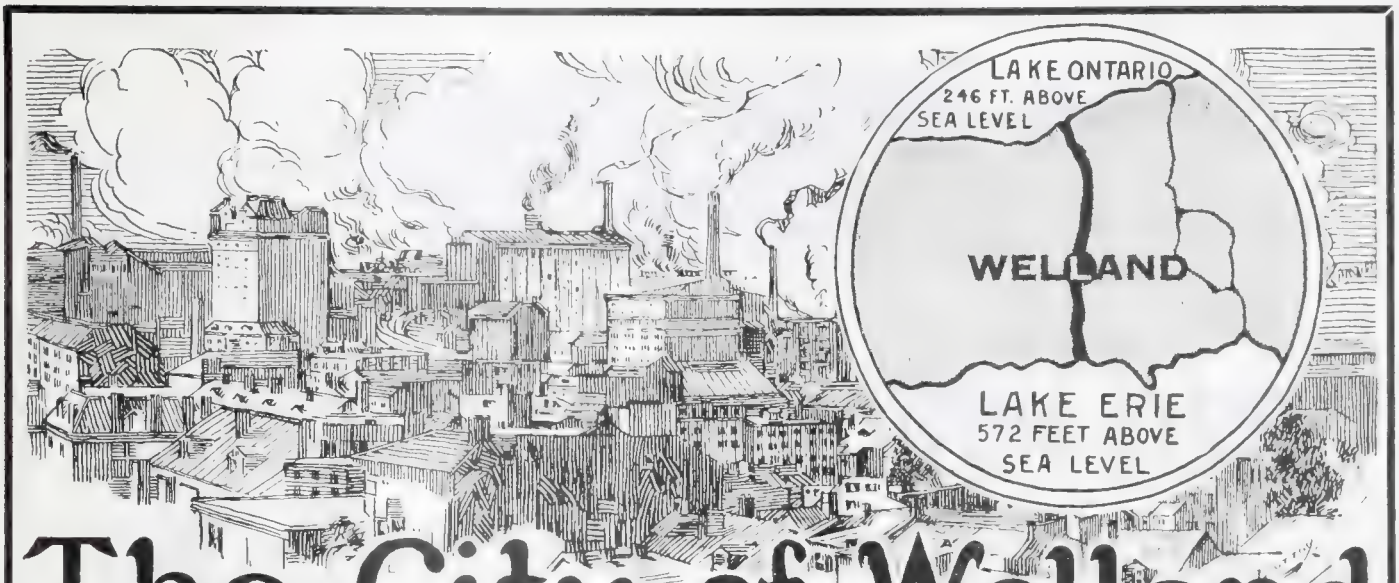
For all ordinary shop grinding wheels specify **"Diamo-Carbo"** —the perfect diamond substitute.

For large, coarse, hard wheels ask for the **"Desmond-Huntingdon."**

Sherman Corrugated, 2 sizes
Norton Zig-Zag, 2 sizes
Magazine
Diamonds

The Desmond-Stephan complete line of Economical Grinding Wheel Dressers is catalogued. Write for copy.

The Canadian Desmond-Stephan Mfg. Company
HAMILTON, ONTARIO
Alfred Herbert, Limited, Coventry, Agent for Great Britain



The City of Welland

offers Every Advantage to Industry

ONE YEAR'S RECORD

The following are extracts from the Welland Industrial Commissioners' report for the year 1918:

Our manufactured product valued at $35,400,340, a substantial growth over the previous year.

Over a million and a half spent in factory buildings and equipment. Though Welland located three new industries last year, only one of these erected new buildings, yet in all $470,771 was spent in new factory buildings and $919,281 in new equipment.

Payrolls exceeded $6,000,000.
In the pay envelopes of Welland's industrial workers there was placed last year $6,466,221, about three times the amount of 1915.

The second year that the City of Welland has been a leader in population growth.
Welland had a gain in population last year of 10.6 per cent., a record that was approached by only one other Ontario city, and, with this one exception, over double the percentage gain of any other Ontario city.

Welland fifth city in Customs Returns. In every hundred dollars collected in customs duties in Canada last year, one dollar was taken in at the Port of Welland.

The Destiny of Welland.

The compilation of our industrial statistics lends a new weight each year to the common prophecy that the City of Welland is destined to be one of the first manufacturing centres of Ontario, and the zone of the Welland Ship Canal, the workshop of the Dominion. Be sure to write for complete details and investigate Welland thoroughly before deciding definitely on your new location.

For particulars, write—

LOUIS BLAKE DUFF

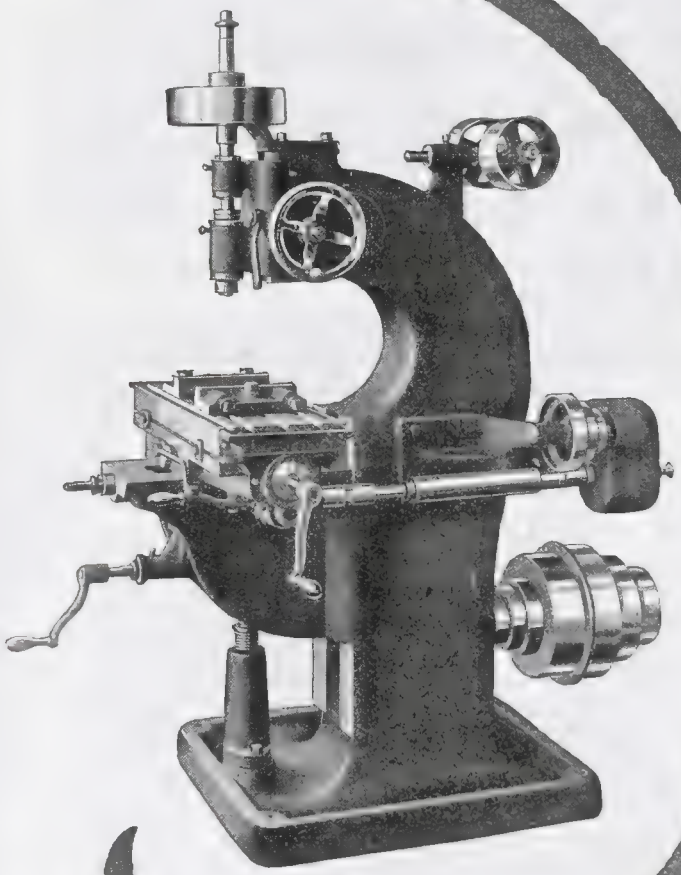
Industrial Commissioner

WELLAND CANADA

BRISTOL

Bristol Vertical Milling Machine

A Tool of Large Capacity



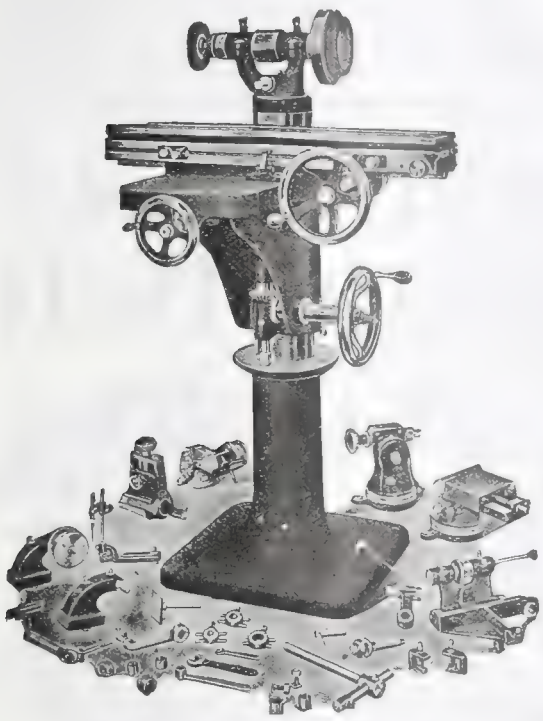
Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.



The Greenfield Universal Grinder

For General Tool Room Work

This grinder is furnished with attachments for grinding all sorts of milling cutters, reamers, counterbores, and other machine shop tools.

It is also suitable for cylindrical, internal and flat work which frequently turns up in the making of tools and jigs.

These attachments are all very simple in design and easily adjusted upon the machine, being graduated so that any desired angles can be at once obtained.

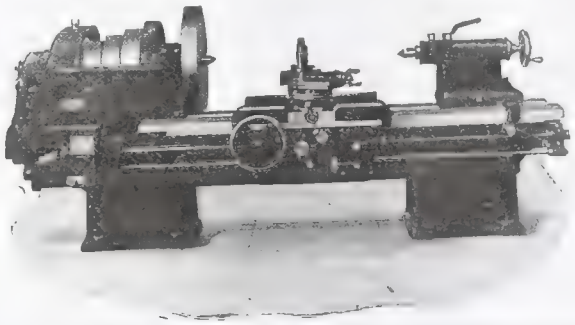
The whole machine is thoroughly well built, well finished, and will be found a dependable, convenient grinder.

Greenfield Machine Company,
GREENFIELD, MASS., U.S.A.

SIDNEY

Sidney for Service

Sidney-for-Service Lathes are noted for their power and rigidity. Take deep cuts through toughest metal without pause or chatter.



Specifications include 3-step cone, double back gear, semi-quick change gear lathe, built on 10 ft. bed. This lathe also furnished with quick-change gears. Bed lengths available: 10, 12, 14, 16, 18 and 20 feet.

The Sidney Line comprises 15-inch, 17-inch, 19-inch, 25-inch, 27-inch, 30-inch and 36-inch lathes, which are adaptable to the finest tool room work or the heaviest duty shipyard or factory rapid production work.

Heavy Duty Engine Lathes

The Sidney Tool Company, Sidney, Ohio

Canadian Agents: The Geo. F. Foss Machinery & Supply Co., Montreal, Quebec. H. W. Petrie, Limited, Toronto, Ontario.

Clipper Belt Lacer Co
REGISTERED TRADE-MARK

Industry and "Clipper" Belt Lacing

ONE hundred thousand Clipper Belt Lacers stand guard, ready for instant duty, in ninety thousand of the world's largest industrial plants. During strenuous years the Clipper kept the wheels of industry turning safely and economically—kept production at the maximum. Loss of time through breakage or adjustment of belts was reduced to the minimum.

There will be no lagging in this year's production—or in the years to come—where the Clipper stands guard to keep the belts of industry moving.

The Clipper Belt Lacer
Laces a Belt in Three Minutes

Before the adoption of the Clipper way of quick belt lacing it took from fifteen minutes to half an hour to make even an inferior joint. No wonder manufacturers hailed the efficient Clipper. No wonder it has been so universally adopted.

Not one but a number of Clipper lacing tools are used in many plants—distributed at convenient points for instant emergency use. No especial skill is required to lace a belt with the Clipper. Any workman can do it.

The Clipper makes a durable and perfect joint—one that pulls better and is safer—that is, flush with the belt on both sides and is as flexible as the belt itself.

The Clipper goes to manufacturers on free trial. It is backed by a perpetual guarantee.

The American Museum of Safety gave the Clipper the only gold medal ever awarded for metal lacing.

The Clipper will as effectively solve your belt lacing problems as it has done in so many other manufacturing plants.

Some mill supply dealer in every city sells the Clipper.

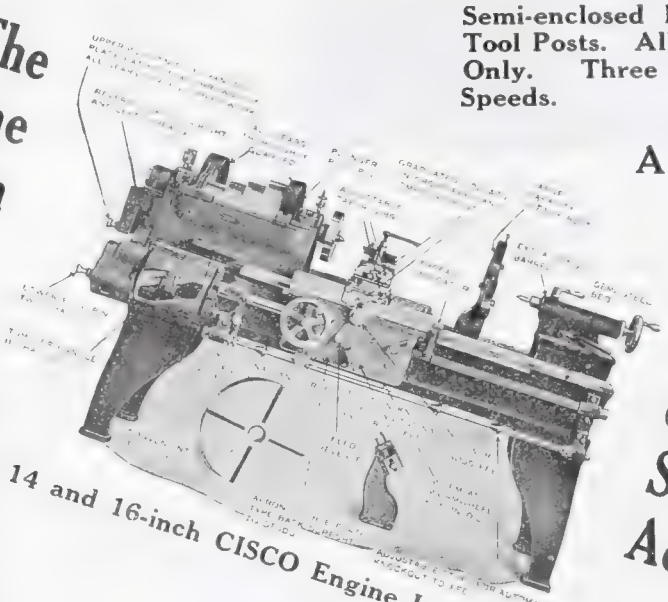
European trade supplied through London office, No. 10 Norfolk St.

Distributors in all parts of the World.

Clipper Belt Lacer Company
GRAND RAPIDS, MICHIGAN, U.S.A.

Every Canadian Shop Should Have One or More Ciscos

The Lathe With the Pull



14 and 16-inch CISCO Engine Lathe.

Semi-enclosed Heads. Drop Forged Tool Posts. All Steel Gears in Apron Only. Three Levers for Feeds and Speeds.

A Cisco satisfies

The Lathe of Simplified Accuracy

.0005 in 18″, or Better
Large Swing
Proportionately Heavy
Simply Operated

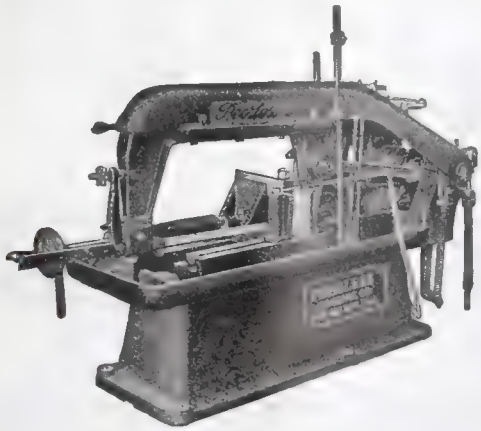
THE CISCO MACHINE TOOL COMPANY, CINCINNATI, U.S.A.

Builders of

14″-16″-18″-24″ Engine and Tool Room Lathes, Cone or Motor Drive, Geared Head, Belt or Motor Drive.

Peerless HIGH SPEED

Has Proven Its Efficiency Where Others Have Failed



DON'T turn down the "Peerless" because you have tried out other hack saws which did not answer your requirements.

Many concerns who were persuaded only with the greatest difficulty to try their first "Peerless," because they "just knew it would turn out like the others," are to-day among the largest and best-satisfied users of our High-Speed Saws.

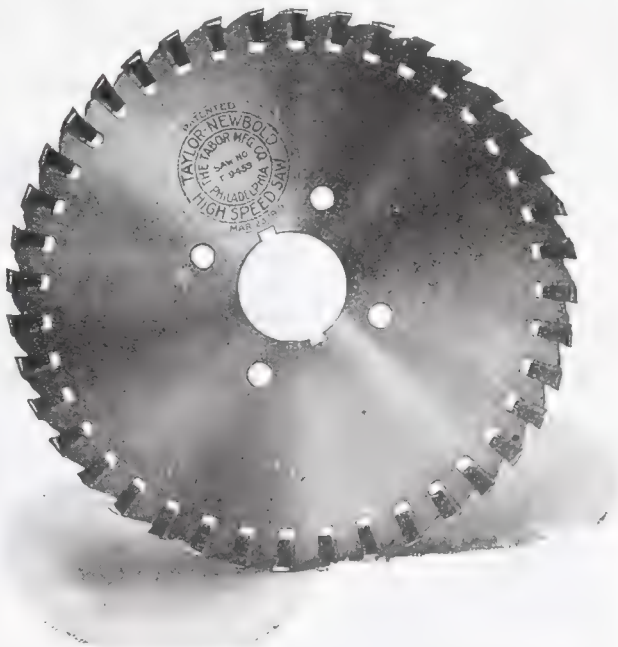
The "Peerless" is different—and better. It does 50 to 100 per cent. more work, cuts with thinner saws and requires a minimum of attendance, saving time, labor, material, blades and floor space. What is your work? We can tell whether the "Peerless" will do it, and back our judgment with a 30-day trial. If it doesn't make good we pay freight both ways. Well?

PEERLESS MACHINE CO.

1607 RACINE STREET RACINE, WISCONSIN

THE IMPROVED

TAYLOR-NEWBOLD



INSERTED TOOTH COLD SAW

WRITE FOR BULLETIN T-S

Tabor Mfg. Co., Philadelphia, Pa., U.S.A.

RICKERT-SHAFER TAPPERS

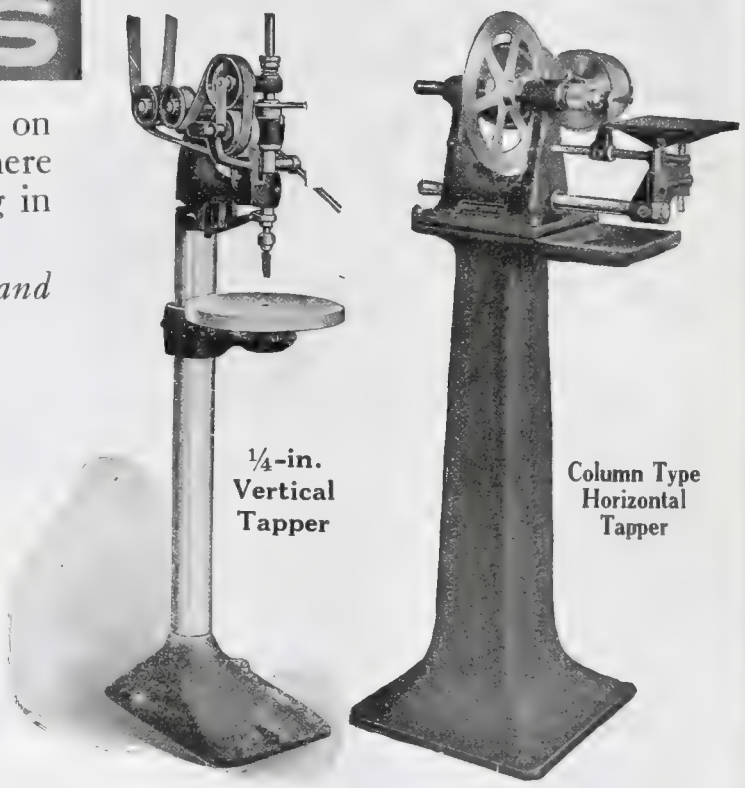
Save Tap Breakage

The *smooth drive* reduces the strain on the taps—they wear longer—and there are fewer delays from taps breaking in the work.

R-S Tappers ensure faster tapping and quicker assembling.

Friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on 5/8-in. work—50 per cent. faster than the usual tapping speed for that size. Uses but 1 h.p.

Write for specifications



¼-in. Vertical Tapper

Column Type Horizontal Tapper

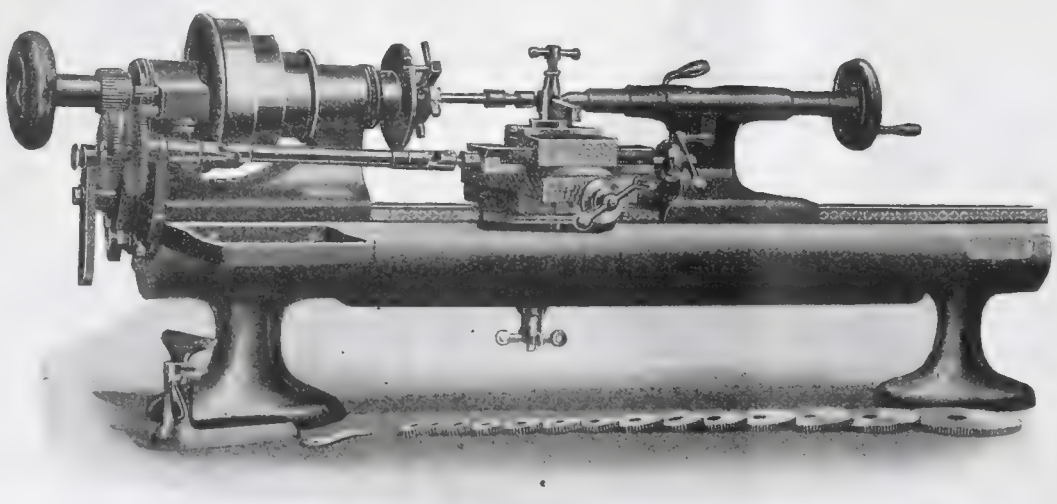
The Rickert-Shafer Co.

ERIE, PA., U.S.A.

FRED HERBERT, Foreign Agent, Coventry, England.

CATARACT BENCH LATHES AND ATTACHMENTS

Cataract Bench Lathes are finely constructed precision tools, with responsive controls, simple adjustments and numerous convenient attachments adapting them to a wide variety of work. **Study this illustration.** Note the base, the circular bed, the sliding tool post, massive head stock (indicating strength), range of gears, special tailstock, arrangement of gears.



Hardinge Bros., 1770 Bertau Avenue, Chicago, Ill.

ALFRED HERBERT CO., Limited, Coventry, England, are our representatives for United Kingdom, France, Belgium, Russia, Japan, Manchuria, Korea, Formosa, China, Italy.

Tycos
TEMPERATURE INSTRUMENTS

Indicating Recording Controlling

Its the instruments that perform the service—not the advertising

Perhaps you will feel it to your advantage to investigate *Tycos* Instruments, and ask us name of installations near you.

Tycos Type Angle and Straight Stem Thermometers
Tycos Recording and Indicating Thermometers
Automatic Temperature and Pressure Regulators
Mercury Vacuum and Absolute Pressure Gauges
Engraved Stem Thermometers
Hygrometers, Hydrometers
Thermo-Electric and Radiation Pyrometers

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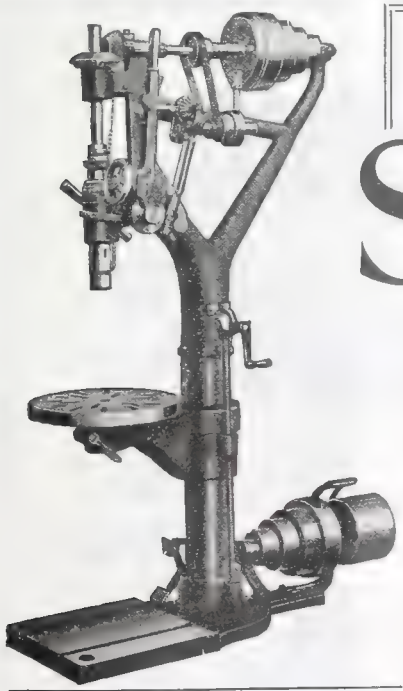
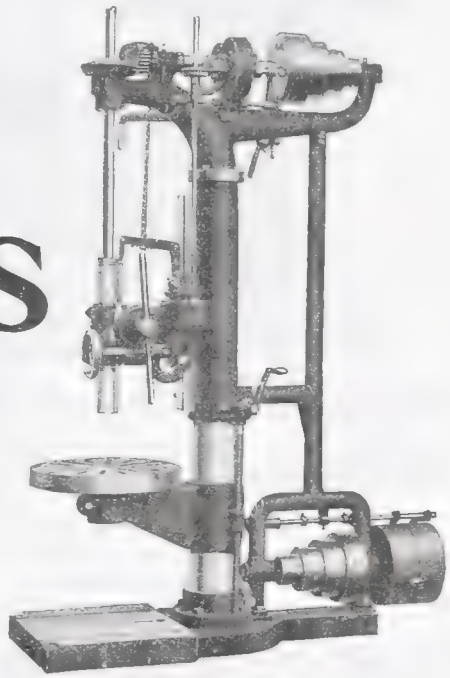
There's a Tycos or Taylor Thermometer for Every Purpose



Meet the keen competition of peace times by putting into your shop faster, stronger and more accurate upright drilling machines. Sixty-four years' drill building experience is back of these perfected

Silver Drills



The 25" Silver Drill has eight spindle speeds and six positive geared feeds. The 20" Silver Drill is built in four distinct styles with round or square base. Furnished singly or in gangs of 2, 3 or 4 spindles.

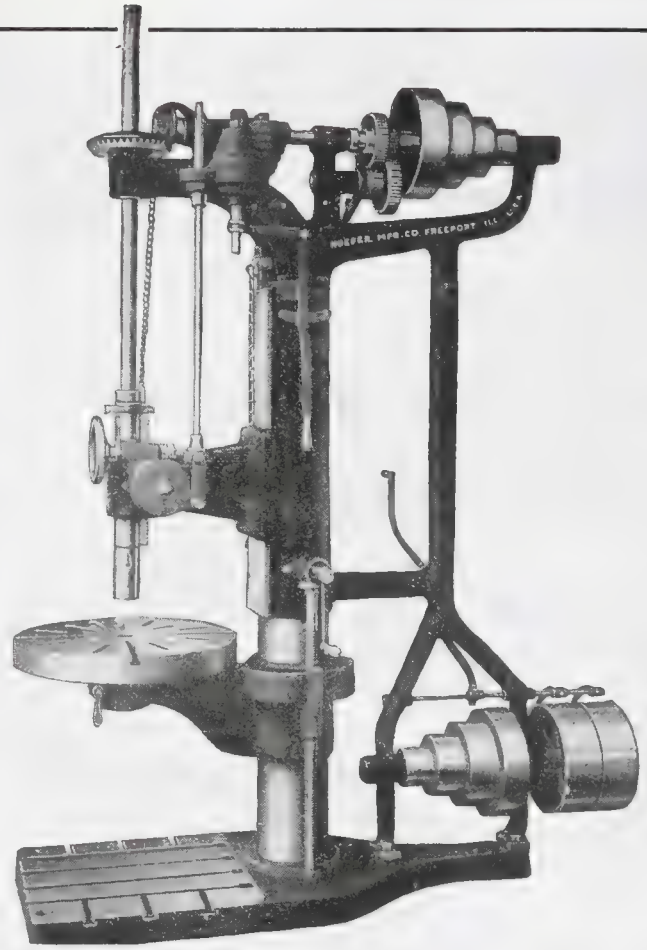
Write for further facts.

SILVER Salem, Ohio U.S.A.

The Silver Mfg. Co.

290 Broadway
SALEM OHIO

Prompt Deliveries



The Know-How of Making A Drill

Twenty-five years of study and practice have given the Hoefer Manufacturing Company the knok-how of making a driller.

And know-how is a lot different from know-it-all. The Hoefer engineers are eternally plugging away to make a better driller.

This is the spirit you'll like in Hoefer service.

If you will set your drilling needs before us, we'll give you the benefit of twenty-five years' contact with some of the drilling problems of the biggest manufacturers in the country.

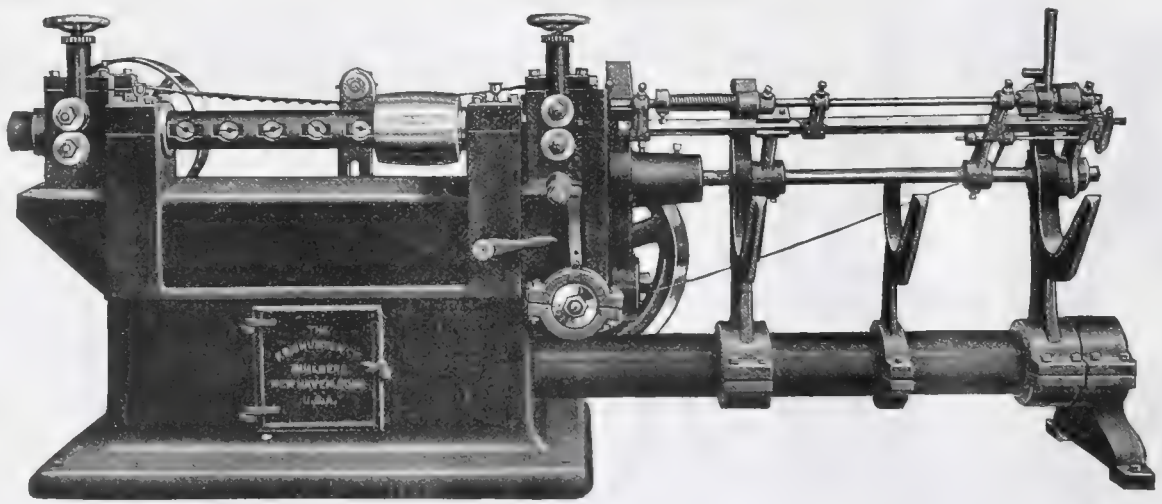
Our product, Hoefer Drillers, embodies the latest word in design, efficiency and accuracy.

Regardless of the size of the press, drilling is possible to a fine degree of precision, provided you use Hoefer Drillers, the recognized standard for a quarter of a century.

Catalog showing complete line on request.

HOEFER MFG. CO.

FREEPORT, ILL.



Perfect Wire Straightening Quickly and Profitably Done on Our

Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

Catalogue tells more about them, and we will be glad to send you a copy.

THE F. B. SHUSTER CO., New Haven, Conn.

FORMERLY JOHN ADT & SON ESTABLISHED 1886

ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.

How long would it take to clean this Cylinder by your present methods—and what would be the labor cost alone?

How long would it take to pay for a Sand-Blast installation from the saving in labor cost if you cleaned it in 3 minutes?

CLEANED IN THREE MINUTES BY

PANGBORN SAND-BLASTS

and whether your requirements are the cleaning of Castings, Forgings, Stampings, Sheet, Plate or Structural, or the removal of scale from Heat Treated Parts there's a Pangborn Unit or Combination for every need, large or small, that will make a saving for you—and a more attractive product.

PANGBORN CORPORATION
HAGERSTOWN, MD.
SAND-BLAST SPECIALISTS
P. O. BOX 8503

"The Marshalltown Throatless Shears"

guarantees perfect work at less than half the ordinary expense.

Rotary, self-feeding shears designed for cutting in and out curves, straight or irregular shearing, circles, also beveling and splitting of plates. Built in various sizes having capacities from tin up to ½" thick. No limit to the size of sheet being cut. Hand, belt or motor drives. The last word in metal cutting shears. We also manufacture Rotary Bevel Shears, Splitting Shears and Plate Milling Machines.

Let us know your requirements.

Marshalltown Mfg. Co.
Marshalltown, Iowa
U. S. A.

Photographic Copying
The PHOTOSTAT
(Trade Mark Registered)

"Orders are now delivered three or four days earlier to our customers by making photographic copies of sketches and drawings which are the same in every detail instead of having our draftsmen reproduce the original.

"Practically all orders were previously held up three or four days by our drafting department while copies of the intricate drawings of ordered tools were being made. Now with the Photostat, only 15 or 20 minutes are required to make the three copies, exact duplicates of the original, which the factory needs to turn out the order. By eliminating this needless delay we are able to provide better service for our customers, and attract new prospects because of prompt deliveries."

This cut shows a PHOTOSTAT on which a large drawing has just been copied in less than a minute.

Never Makes a Mistake

It is simple, practical, easy to handle. Requires no expert knowledge. The machine is loaded with a roll of sensitized paper especially manufactured for the purpose.

The original subject is photographed directly upon this paper producing a facsimile copy which is immediately cut off, developed and fixed right in the PHOTOSTAT itself.

The focusing, exposing and developing are all controlled by simple mechanical devices and no glass plate, film or other intermediate negative has to be made.

After fixing, the copy is removed to a tank of running water and rapidly washed free from chemicals. It is then dried and is ready for use. As many copies as desired may be run off in this manner.

By a simple adjustment of the mechanical focusing device the copy may be made at actual size, reduced, or enlarged, within the size limitations of the machine.

Error in copy is impossible because every copy is an absolute facsimile. The operations are all simple, such as a boy or girl can do.

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Contracts, Ledger Pages,
Illustrations for Salesmen, Insurance Records,
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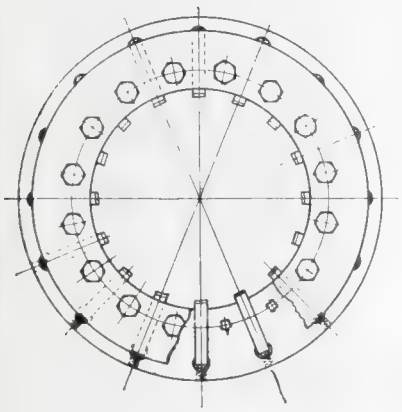
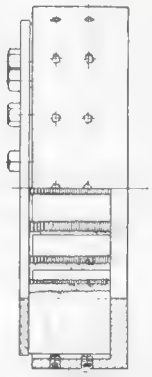
SMALLEY
GENERAL THREAD MILLER





Cuts Quality Milling Costs

Smalley-General Thread Miller reduces costs, increases output and improves the accuracy of the finished product. Accompanying blue-prints and time studies show results that should interest you.

MACHINE—Smalley General Thread Miller No. 1.
PIECE MILLED—Chasers for 8″ pipe die. Two sets milled at one time.
THREAD—Diameter, 8½″; length, 3⅝″; 8 pitch, Briggs, Ltd.
TIME STUDY—

	Min.	Sec.
Inserting jig in chuck		30
Champfering for leading threads	5	
Milling roughing cut	13	
Finishing cut	8	
Removing jig from chuck		30
TOTAL TIME	27 minutes	

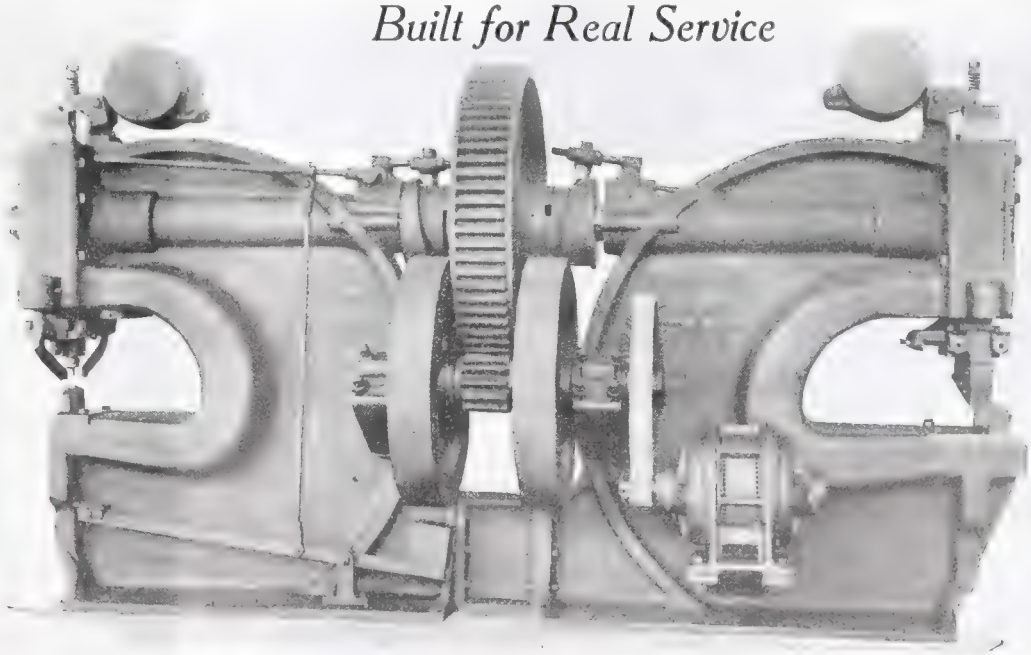
for two sets of chasers or 13½ minutes per set.
MILLING FEED—Roughing cut, 2″ per minute. Finishing cut, 3″ per minute.
MATERIAL—Rex A Tool Steel.
NOTE—Jig was arranged so as to hold two sets of chasers. Chuck was an air collet.

Consult us on every phase of thread milling. We will show you how to cut the costs.

Smalley General Company, Inc.
Bay City, Michigan

Canadian Agents: Rudel-Belnap Co., Ltd., Montreal and Toronto

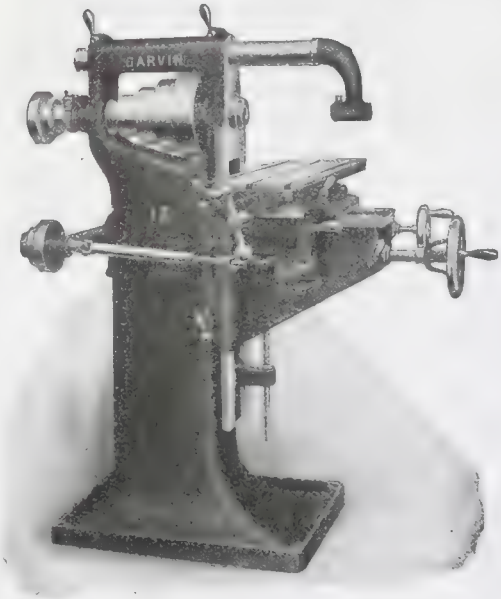
WICKES' Heavy Duty Double Punch
Built for Real Service



We also manufacture High Grade Horizontal and Vertical Rolls, Angle Rolls, Single Punches, Shears, Spruce Cutters Radial Wall Drills or Counter-sinking Machines, Flanging Clamps and Heavy Duty Engine Lathes. *Ask for Catalogue.*

WICKES BROS., SAGINAW, MICH., U.S.A.

GARVIN



No. 12 Plain Milling Machine-Use Code Abrade

NO. 12 PLAIN MILLING MACHINE

FOR ALL LIGHT MANUFACTURING

This machine is built especially strong and substantial for a tool of its capacity, and has many valuable features worthy of special mention. The slide is fitted with a quick pitch screw, giving one inch per turn. This combines the rigidity of a rack feed with the steadiness of the screw feed. The table has an oil pan all around it, with finished edges—automatic feed, trip and reverse—adjustable nut on the feed screw to take wear—the Feed Screw is hardened.

Adjustments .....18 x 6 x 15 in.

For Further Information ASK YOUR DEALER or WRITE US DIRECT

IMMEDIATE DELIVERIES

Send for Complete Catalog

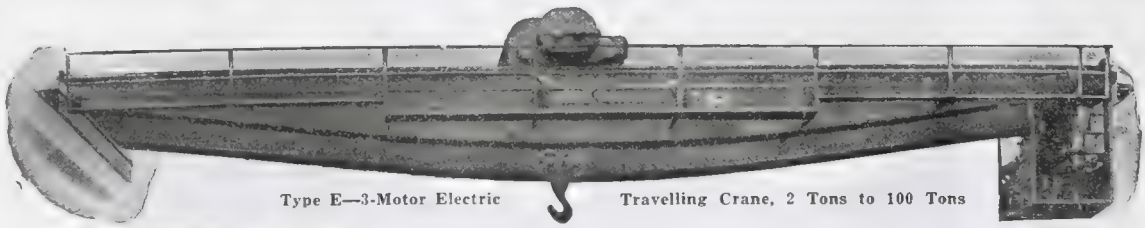
Manufactured by

THE GARVIN MACHINE COMPANY

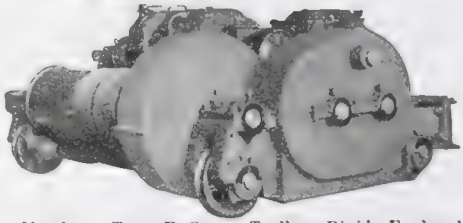
Spring and Varick Streets ***(Visitors Welcome)*** **50 Years New York City**

CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes

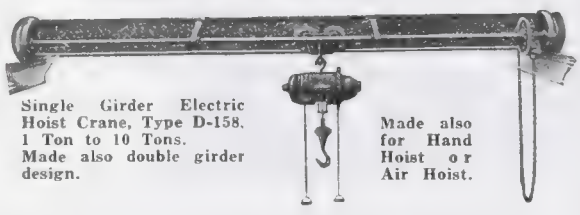


Type E—3-Motor Electric Travelling Crane, 2 Tons to 100 Tons



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



Single Girder Electric Hoist Crane, Type D-158, 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.

Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

One Customer Says:

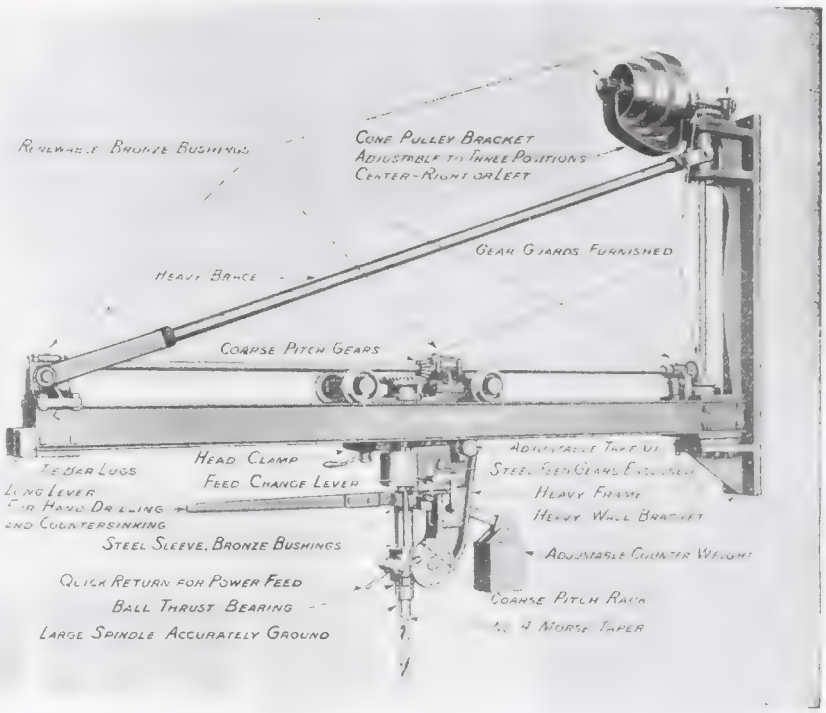
"These machines were put in operation immediately upon arrival, have been producing ten hours per day every day since, and we have never experienced a bit of trouble with same." We know you will appreciate what this means in any shop, and believe this is the sort of machine you are looking for. We consider the machine the finest in its line on the market to-day, and believe an installation would save money for you in the cost of your production.

Our illustrated bulletin will interest you, giving detailed information.

MADE IN FOUR STANDARD SIZES

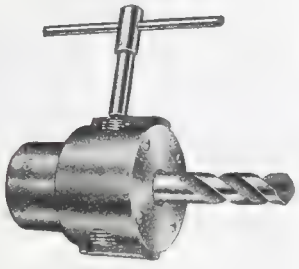
Rated size	Drills to center of	Wall to end of arm
7 ft.	14 ft. circle	10 ft.
9 ft.	18 ft. circle	12 ft.
11 ft.	22 ft. circle	14 ft.
13 ft.	26 ft. circle	16 ft.

F.O.B. Boston, Mass.



LYND-FARQUHAR COMPANY

419-425 Atlantic Avenue **BOSTON, MASS.**



UNION

POSITIVE DRIVE DRILL CHUCKS

The Union Drill Chuck is made in seven sizes (0 to 2 inches) with PATENT TRANSVERSE SLOT—so that drills with tenons can be inserted (see illustration). The shank of drill should be squared on two sides to enter the TRANSVERSE SLOT, giving a positive rotation to the drill independently of the jaws, permitting the jaws to centre and align the drill accurately. The drill is held absolutely true and will not slip under the hardest strain. This type of chuck will be found to give the best results on all classes of work from HIGH SPEED drilling to the hard BLACKSMITH and GENERAL REPAIR work.

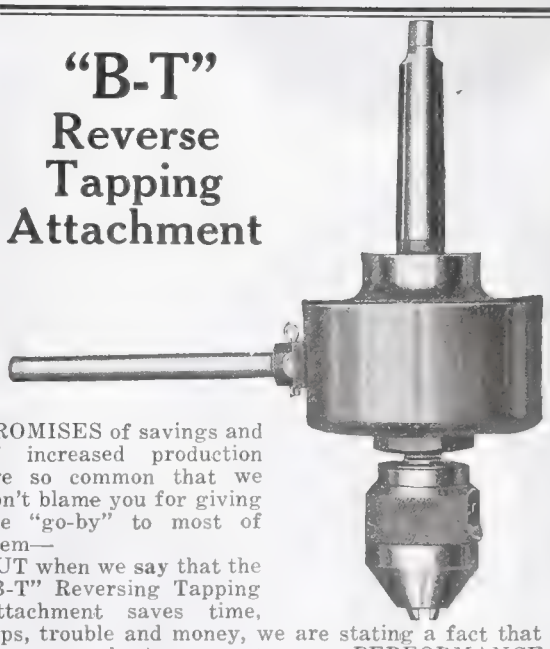
UNION Manufacturing Co.

New Britain, Conn.

New York Office 26 Cortland St.

Makers of a complete line of chucks

"B-T" Reverse Tapping Attachment



PROMISES of savings and of increased production are so common that we don't blame you for giving the "go-by" to most of them—

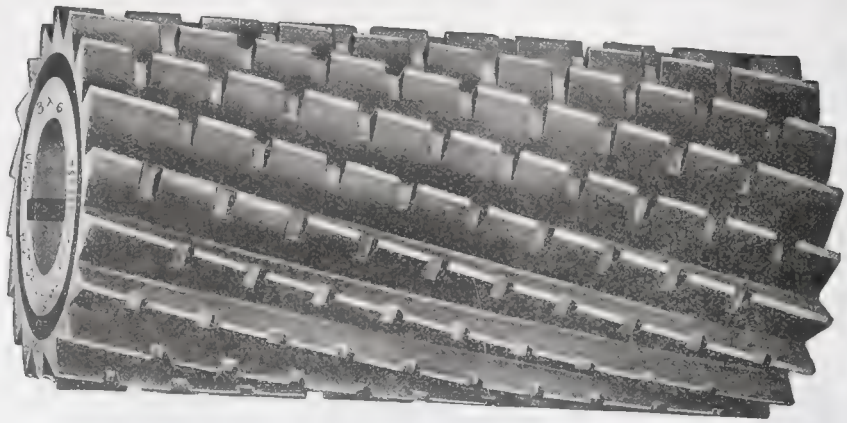
BUT when we say that the "B-T" Reversing Tapping Attachment saves time, taps, trouble and money, we are stating a fact that we are ready to prove to you—PERFORMANCE in your own shop will show the "B-T" advantages. Equipped with friction drive—automatically adjusts itself to pressure, eliminating reversing strains and preventing tap breakage due to binding or other breaking stresses. Made also with positive drive.

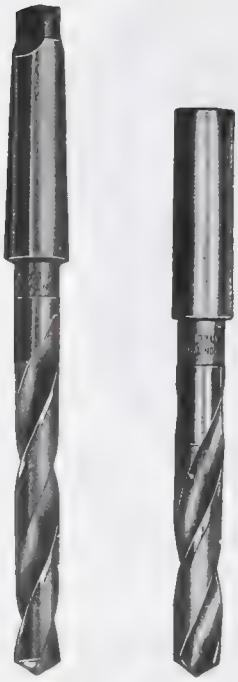
Trial will Prove. Write for our proposition.

Bicknell-Thomas Company

Greenfield, Mass., U.S.A.

Canadian Representative: The Jas. Buckley Co., St. Nicholas Bldg., Montreal, P.Q.





BUTTERFIELD

TWIST DRILLS GEAR AND MILLING CUTTERS

(Carbon and High Speed Steel)

It will pay every manufacturer, who is not acquainted with Butterfield Tools, to measure their quality by the test of long, hard SERVICE.

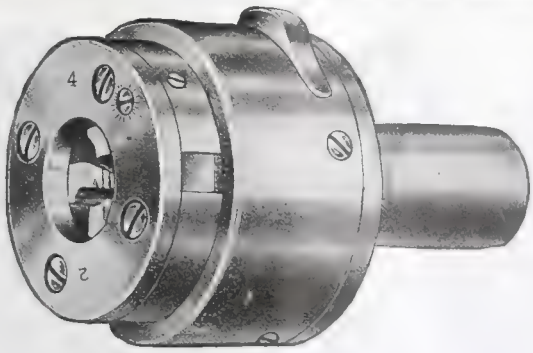
You'll find the Butterfield durability the key to tool economy.

Drop us a line for catalogue.

Butterfield & Company, Inc.

Rock Island, Quebec

Toronto Office:
220 King Street West



H & G Die Heads

are of small outside diameter compared with the size of work they do.

The H. & G. illustrated is an automatic, self-opening Die Head designed especially for use on Gridley and National Acme Multiple Spindle Screw Machines and others that use the die in a revolving position. The four sizes of this Head cut up to 9/16", 1", 1¼" and 1½".

All parts are hardened and ground and interchangeable. In a word—it's an H. & G.

Ask for Catalog

Eastern Machine Screw Corp.

New Haven, Conn., U.S.A.

CUSHMAN

We've been Manufacturing

Nothing but Chucks and Their Accessories

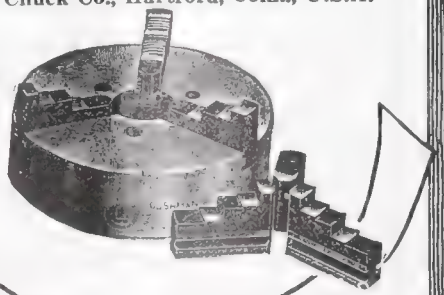
FOR NEARLY 60 YEARS

AND OUR PRODUCTS SHOW IT

Years of experience in using our tools has convinced manufacturers that the word "Cushman" stamped upon a chuck is a guarantee of its quality and efficiency.

Let us send you our catalogue.

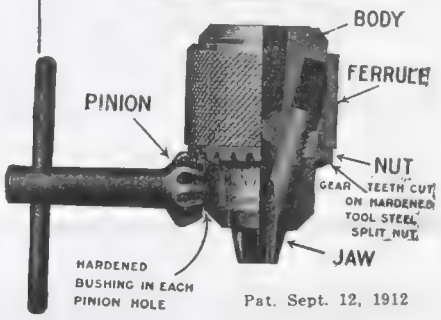
Cushman Chuck Co., Hartford, Conn., U.S.A.



ALMOND CHUCKS & MICROMETERS

Give them a try out. Universal Geared Scroll Chuck—Sizes 5", 6", 7½", 9" and 12".

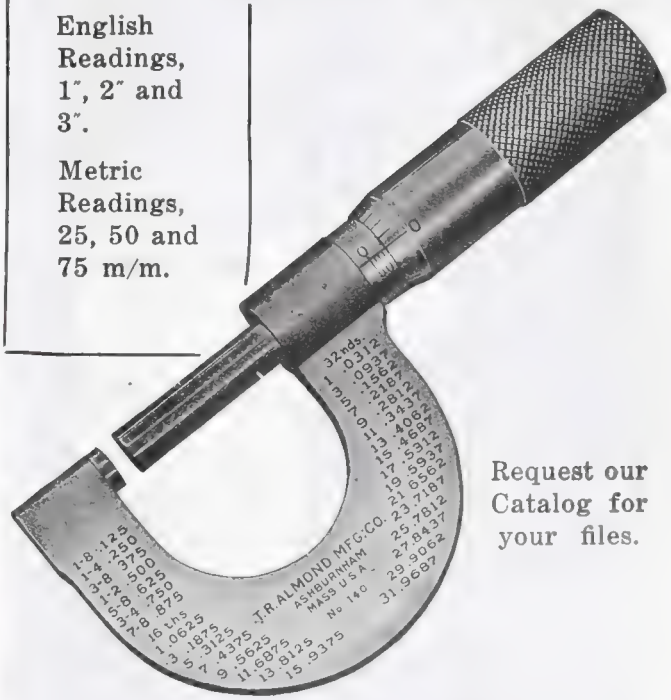
Geared Nut Drill Chucks, in various capacities, 0" to 1".



Micrometer Calipers—

English Readings, 1", 2" and 3".

Metric Readings, 25, 50 and 75 m/m.



Request our Catalog for your files.

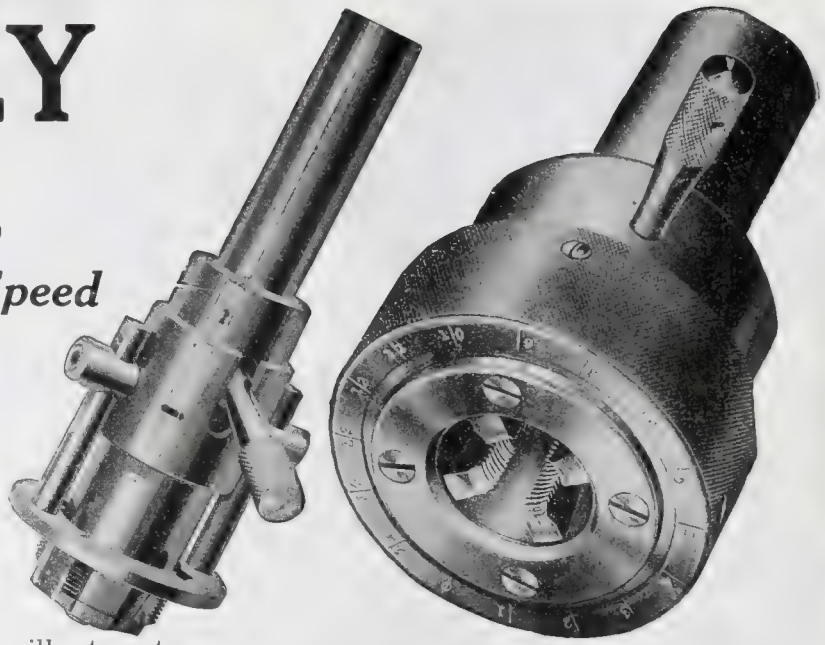
T. R. ALMOND MFG. CO.

6 Maple Avenue, Ashburnham, Mass.

MURCHEY

COLLAPSING TAPS and SELF-OPENING DIES

Promote Accuracy and Speed



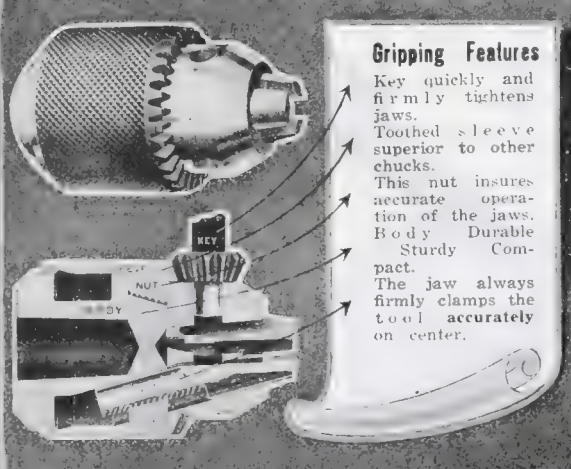
MURCHEY Collapsing Taps and Self-Opening Dies are cleared free from the thread instantly, preventing all danger of stripping, besides cutting time for production in half. **Thus you are sure of greater accuracy and greater production.** Murchey Tools are speeding production in all parts of the country on tapping machines, drill presses, monitor machines, boring mills, turret lathes, and all other machines to which taps or dies may be attached.

Let us know the class of work you are handling and we will show you how to increase your production 50 per cent. without running up the cost.

Murchey Machine & Tool Company, Detroit, Mich.

THE COATS MACHINE TOOL CO., Caxton House, Westminster, London, England, Glasgow, Newcastle-on-Tyne.
FENWICK FRERES & CO., 15 Rue Fenelon, Paris, France.

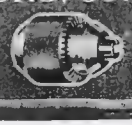
JACOBS IMPROVED DRILL CHUCK



Gripping Features

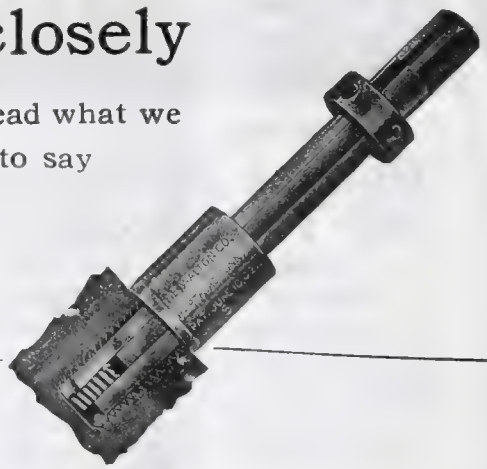
Key quickly and firmly tightens jaws.
Toothed sleeve superior to other chucks.
This nut insures accurate operation of the jaws.
Body Durable Sturdy Compact.
The jaw always firmly clamps the tool accurately on center.

THE JACOBS MFG. CO.
HARTFORD, CONN. U.S.A.



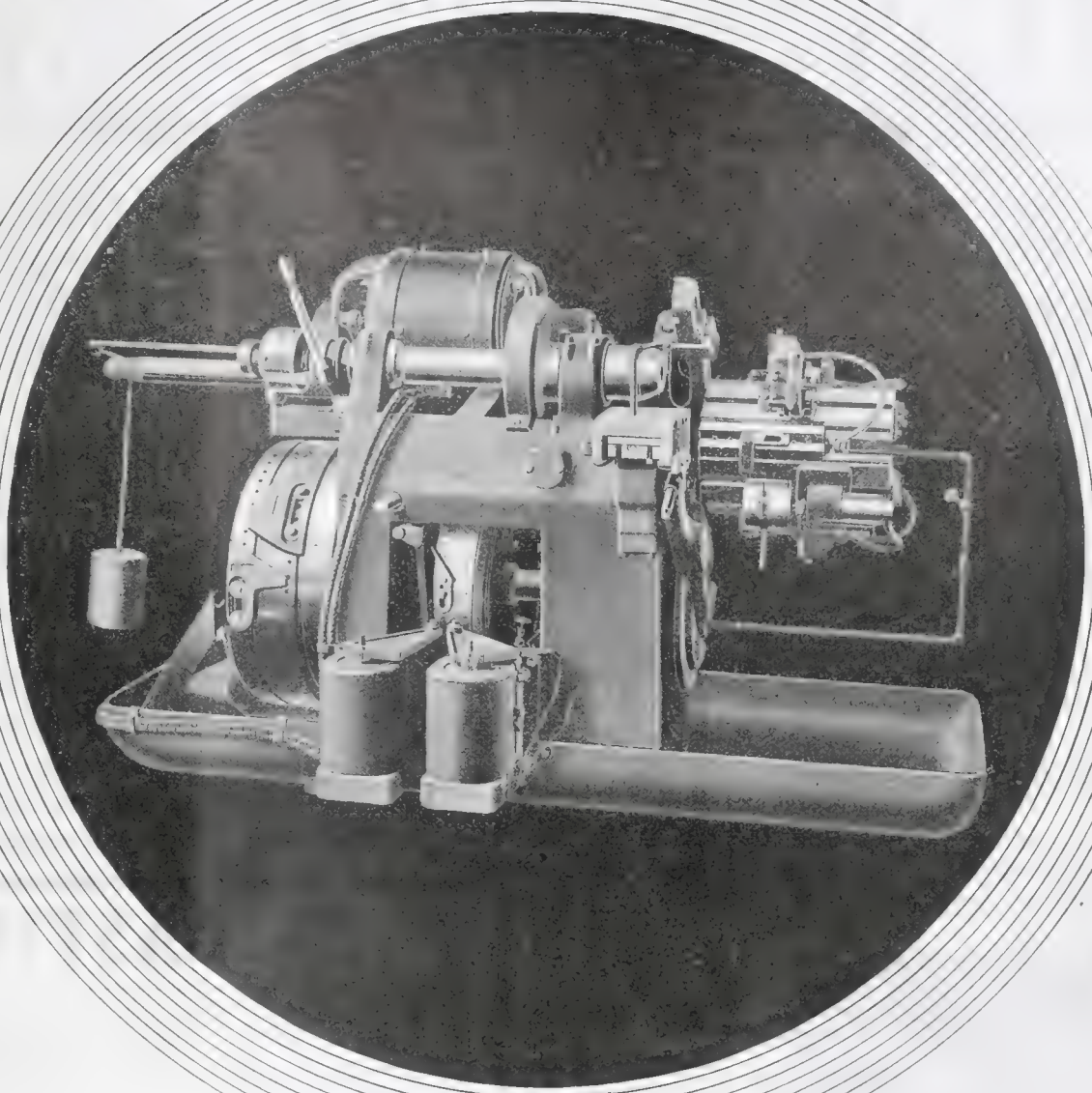
Look at this again —closely

and read what we have to say below



WHEN a tap breaks off close or below the surface, you'll find this Walton **Tap Extractor will save a great deal** of time and trouble. The crucible fingers grasp the flutes of the tap, a twist of the wrench and the piece is out.
Don't you think it would pay to have a few lying around on your benches?

The Walton Company
Hartford, Conn.



Let's be specific:

A comparison of two different Turret Lathe jobs for accuracy or for output, merely on heresay or opinion has often resulted in a new attitude when the real figures were known.

Gridley Automatic Turret Lathes stand or fall by their specific performance on *your* work in your shop. May we quote you *specifically?*

Capacities 2¼-5".

THE NATIONAL ACME COMPANY

AUTOMATIC SCREW MACHINERY AND ITS PRODUCT

CLEVELAND WINDSOR NEW YORK BOSTON CHICAGO DETROIT MONTREAL

Representatives in Principal Foreign Countries

HINTS TO BUYERS

DARLING BROTHERS, LIMITED
Engineers, Manufacturers and Founders
120 Prince Street, MONTREAL, P.Q.
Pumps for any Service—Steam Appliances—Freight Elevators—Webster Vacuum Heating System.

PRESSES and SHEARS
Sheet Metal Working Machinery
THE D. H. STOLL CO., INC.
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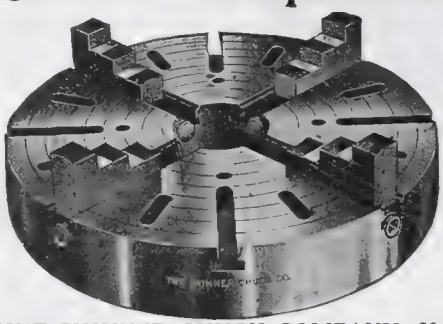
JAMES BALLANTYNE
HEATING and PLUMBING CONTRACTOR
ALSO
MACHINE SHOP and BLACKSMITH WORK
163 NAZARETH ST.
MONTREAL, P. Q.
Machine Work Wanted for Lathes, Shaper, Milling Machine and Planer, etc.
Quotations given on all classes of work. Wrought Iron Pipe Bends made to order, ¼ to 8". Pipe Cut and Threaded, ⅛ to 12".
Write for Prices.

TRADE MARK
BRISTOL'S REG. U.S. PAT. OFFICE
ELECTRIC PYROMETERS
FOR EVERY SERVICE

Bristol's Recording Pyrometer furnished with patented frictionless smoked chart recording system, especially valuable for processes requiring continuous heat treatment.
Simplicity of construction and ruggedness make them ideal shop pyrometers. The ONLY pyrometer equipped with Weston milli-voltmeter movement.
Write for Bulletin I-205.
THE BRISTOL CO.
WATERBURY, CONN., U.S.A

Skinner Independent Chucks

FOR HIGH SPEED WORK
IRON OR STEEL BODY
The last word in chuck construction.
Wide jaws; hardened steel thrust bearings; adjusting screws of large diameter, threaded full length; jaws ground after hardening, etc.
Write us to-day for prices.
THE SKINNER CHUCK COMPANY, New Britain, Conn.
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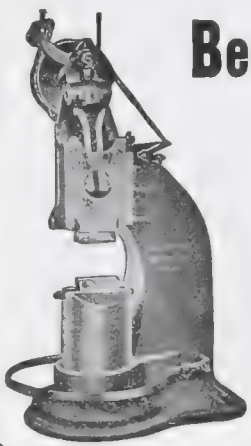
Factory and Main Office: New Britain, Conn.
London Office: 149 Queen Victoria Street
San Francisco Office: Rialto Building

STEEL CASTINGS
ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.
PROMPT DELIVERY
Manitoba Steel Foundries, Ltd.
1204 McArthur Building
Winnipeg - - - Manitoba


Beaudry Hammers
FOR GENERAL FORGING
Save Fuel, Time and Labor. Cut Forging Costs in two.
BELT OR MOTOR DRIVEN
BEAUDRY & COMPANY, Inc.
141 Milk Street, Boston, Mass.
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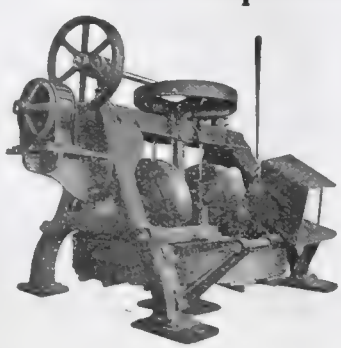
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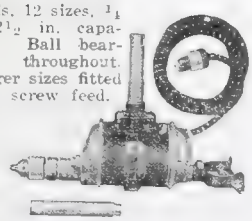

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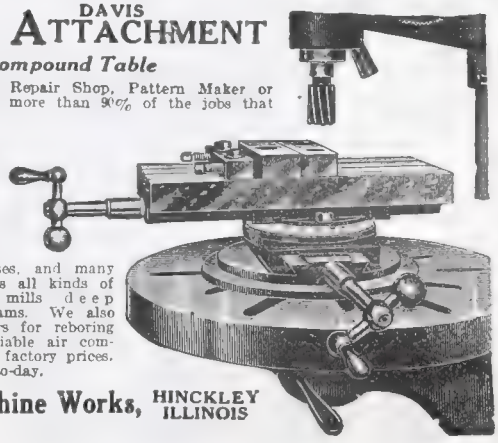

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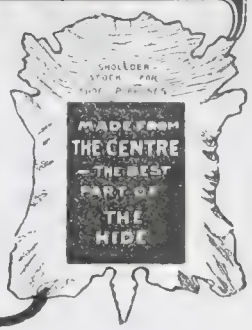

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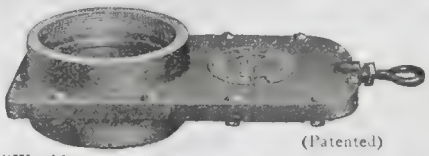

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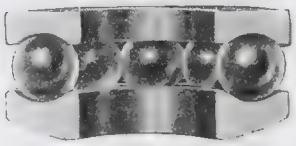

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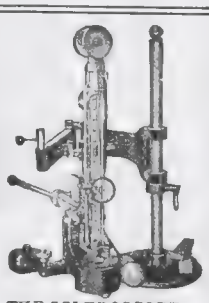

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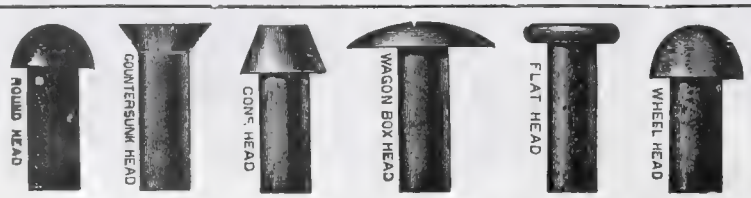

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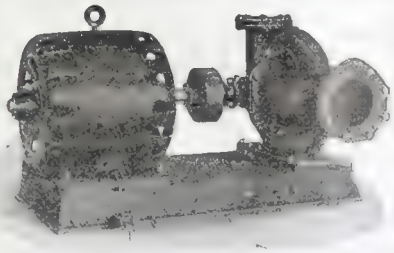

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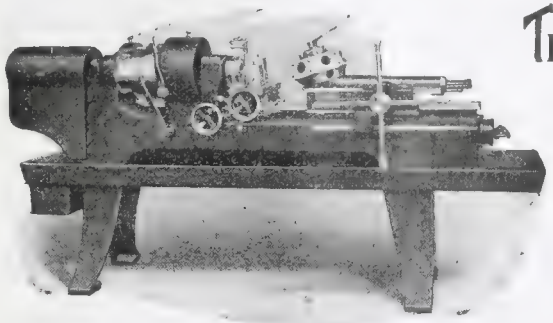

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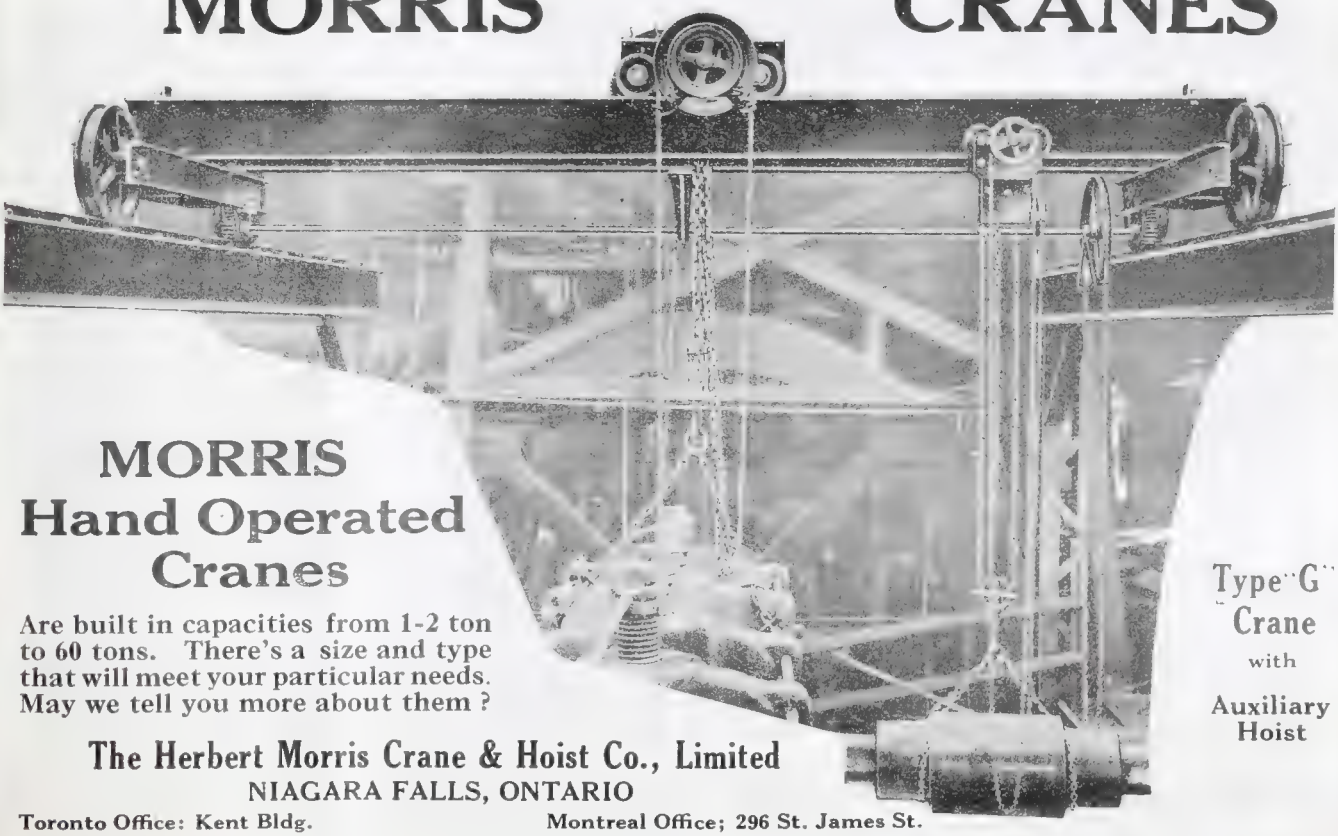

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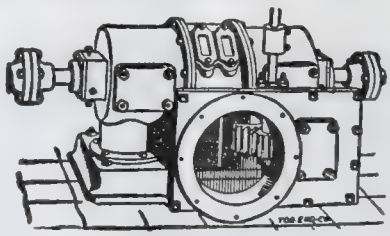

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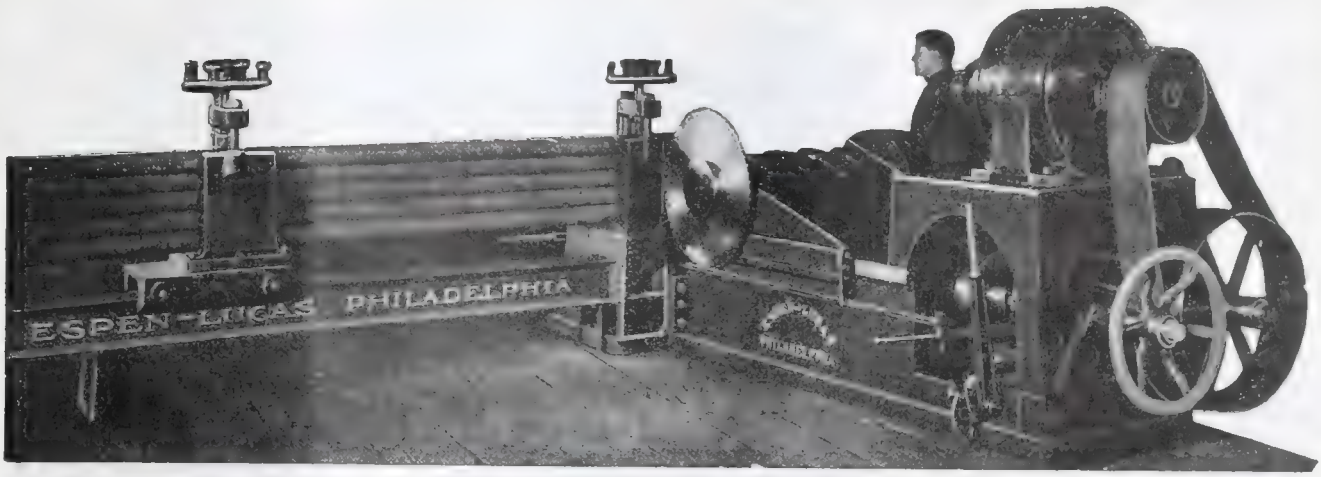

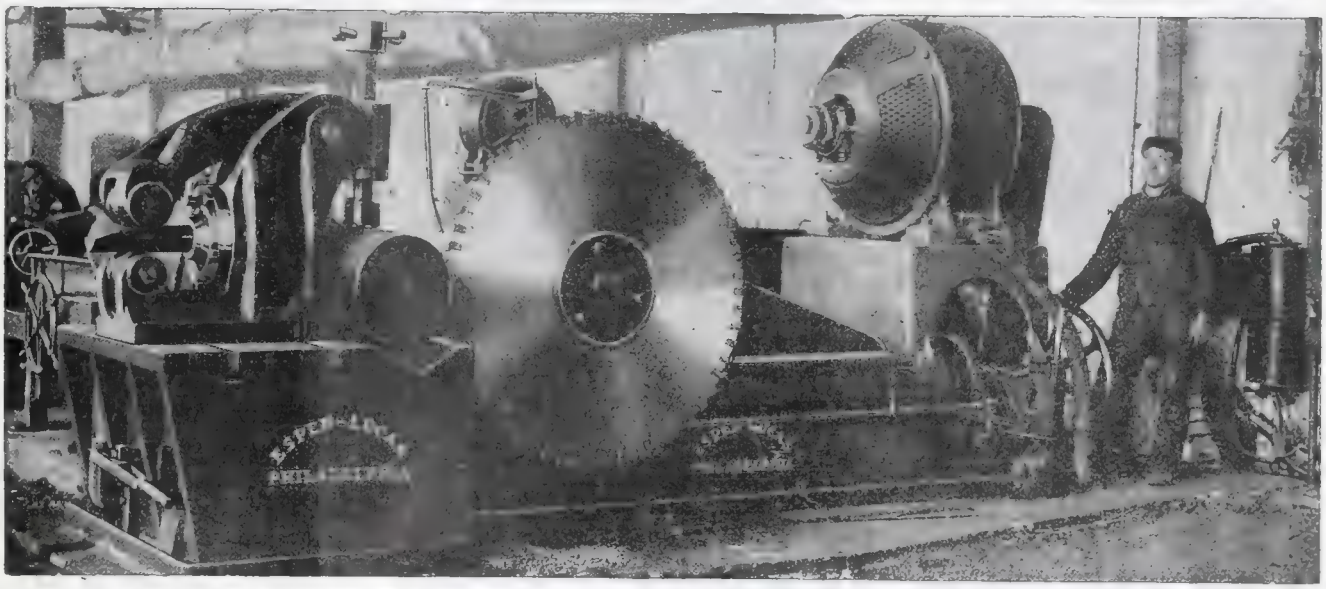

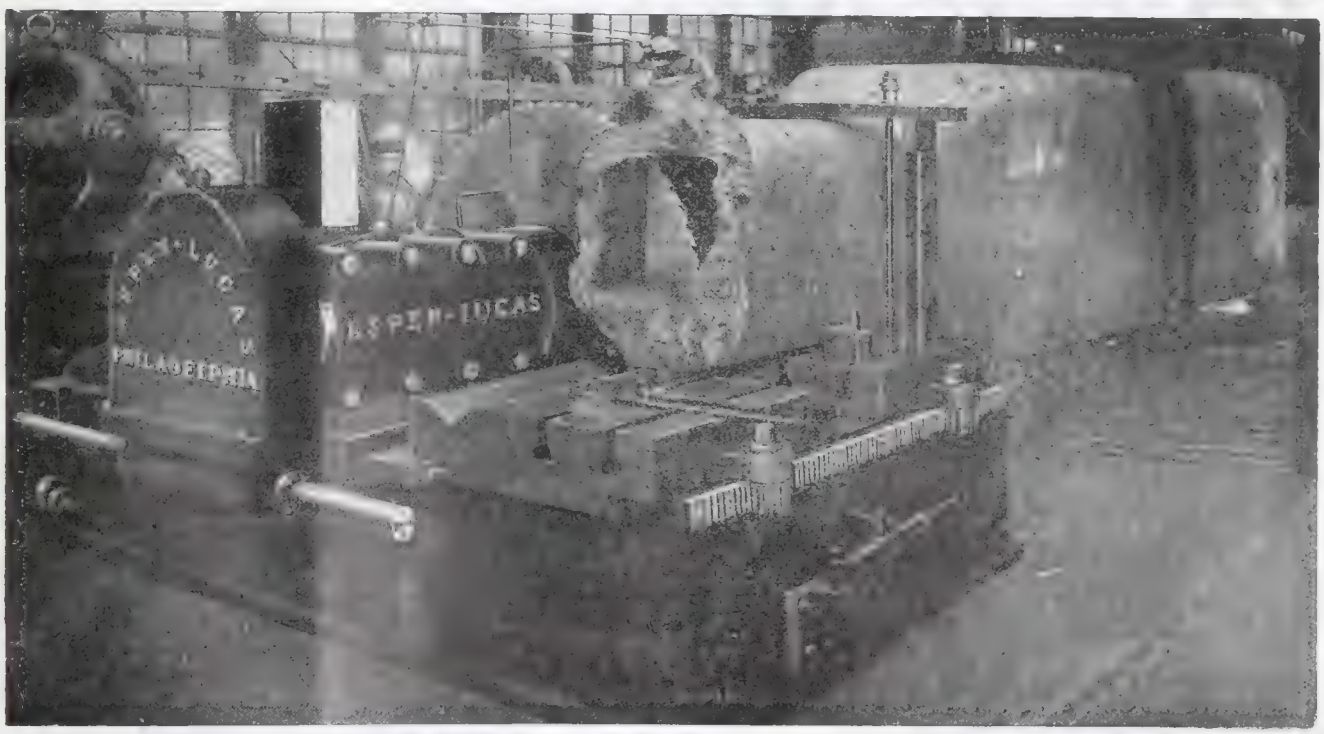

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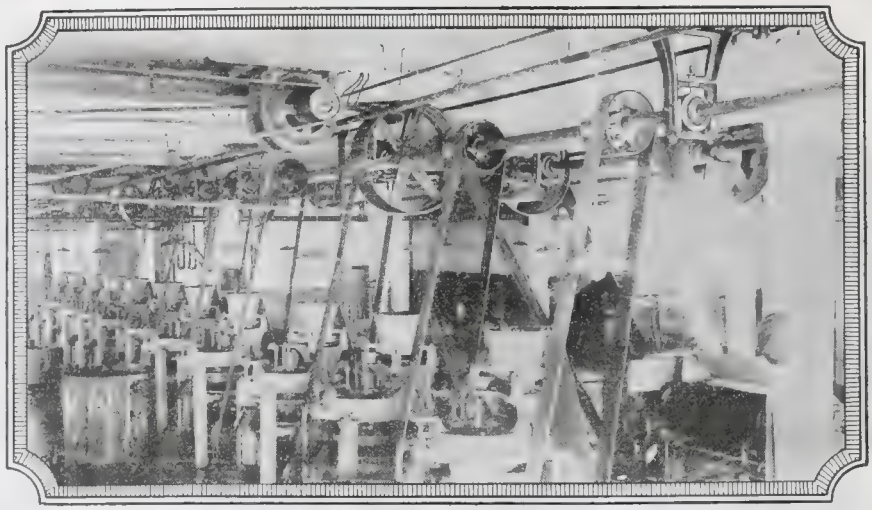

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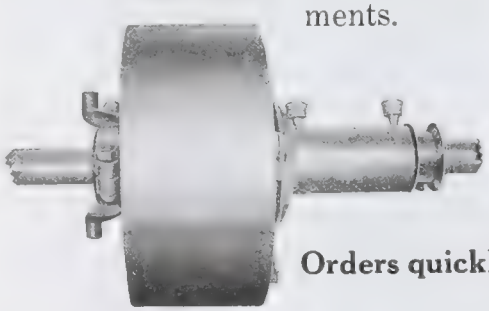

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Garlock-Walker Machinery Co., Toronto, Ont.
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Niles-Bement-Pond Co., New York.
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Kayser-Ellison & Co., Ltd., Montreal.
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CHROME NICKEL STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

CHROME VANADIUM STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

CRUSHED STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa

CUPOLAS
Can. Blower & Forge Co., Kitchener, Ont.
Northern Crane Works, Walkerville.
Sheldons, Ltd., Galt, Ont.

CUPOLA BLAST GAUGES AND BLOWERS
Sheldons, Ltd., Galt, Ont.

CURB PUMPS FOR OIL AND GASOLINE
Bowser & Co., S. F., Inc., Fort Wayne, Ind.

CURRENT TRANSFORMERS
Electric Steel & Metals, Ltd., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
J. C. Wilson & Co., Belleville, Ont.
Williams & Wilson, Limited, Montreal, Que.

CUTTERS, BOLT
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Limited, Montreal, Que.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co. of Canada, Toronto

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich.

CUTTERS, PIPE (SEE PIPE CUTTERS)

CUTTERS, MILLING
Becker Milling Machine Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Machine Co. New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Rice, Lewis & Son, Toronto Ont.
Tabor Mfg. Co. Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.

CUTTING-OFF MACHINES
Armstrong Bros. Tool Co., Chicago.
Bertram & Sons Co., John, Dundas.
Canadian Fairbanks-Morse Co., Ltd., Montreal
Curtis & Curtis Co., Bridgeport, Conn.
Foss Mchy. & Supply Co., The Geo. F., Montreal
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hurlburt, Rogers Machy Co., South Sudbury, Mass
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Peerless Machine Co., Racine, Wis.
Prest-O-Lite Co., Inc., Toronto, Ont.
Racine Tool & Machine Co., Racine, Wis
Standard Mchy & Supplies, Ltd., Montreal, Que
Tabor Mfg. Co. Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Limited, Montreal, Que

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto

CUTTING OIL, RECLAIMING SYSTEM
Bowser & Co., S. F., Inc., Fort Wayne, Ind.

CUTTING AND WELDING PLANTS
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor, Ont.

CYLINDERS, AIR
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich.

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Hinckley Machine Co, Hinckley, Ill.
Kelley Reamer Co., Cleveland, O.

DEEP DRAWING DIE STEEL
J. F. A. Comstedt, New York City, N.Y.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co. Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DIAMOND TOOLS
Anderson & Co. of Can., Geo., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Windsor, Ont.
Wheel Trueing Tool Co., Detroit.
Williams & Wilson, Limited, Montreal, Que.

DIAMONDS, CARBON & BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE BLOCKS
General Steel Co., Milwaukee, Wis.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Limited, Montreal, Que.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pittsburgh Steel Stamp Co., Pittsburgh, Pa.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Banfield, W. H., & Son, Toronto.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Canadian Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy & Supply Co., Montreal.
Gardner, Robt., & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Standard Machy. & Supplies, Ltd., Montreal
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams & Wilson, Limited, Montreal, Que.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Butterfield & Co., Rock Island, Que.
Landis Machine Co., Waynesboro, Pa.
Williams & Wilson, Limited, Montreal, Que.

DIES, THREADING
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston, Mass.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.

DIES, BOLT, PIPE
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt, Ont.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit, Mich
Wells Brothers Co. of Canada, Galt, Ont.
Williams & Wilson, Limited, Montreal, Que.

DIE BLOCKS, HEAVY FORGED
Hammond Steel Co., Inc., Syracuse, N.Y.

DIE FORGINGS
Hammond Steel Co., Inc., Syracuse, N.Y.

DIE FILING MACHINES
Oliver Machinery Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong, Whitworth of Canada, Montreal, Que
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

DIES FOR SCREW PLATES
Wells Brothers Co. of Canada, Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.
Windsor Mach. & Tool Co., Windsor, Ont.
Worth Engineering Co., Toronto, Ont.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.

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THE CLEVELAND TWIST DRILL CO., Cleveland, New York, Chicago

Agents for Europe, CLEVELAND TWIST DRILL CO. (GREAT BRITAIN), Ltd., 36-37 Upper Thames St., London E.C.4.

Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Ltd., Montreal.

DIRECT CONNECTED UNITS
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W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.

DRAWING
Henry Hope & Sons of Canada, Ltd., Peterboro.

DRESSERS, GRINDING AND EMERY WHEEL
Baxter & Co., Ltd., J. R., Montreal, Que.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Ford-Smith Mach Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.
Williams & Wilson, Limited, Montreal, Que.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp, Galt, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
United States Mach. Tool Co., Cincinnati, O.
A. R. Williams Machinery Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport, Conn.
Canada Machinery Corp., Galt, Ont.
Silver Mfg. Co., Salem, Ohio.
Williams & Wilson, Limited, Montreal, Que.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach. Co., Rockford, Ill.

DRILLING MACHINES RADIAL AND TURRETT
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Reed-Prentice Co., Worcester, Mass.
Williams & Wilson, Limited, Montreal, Que.

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
D McKenzie Machinery Co., Guelph, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati, Ohio.
Williams & Wilson, Limited, Montreal, Que.

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Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Machinery Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Giddings & Lewis Mfg. Co., Fond du Lac, Wis.
Fry's (London), Ltd., London, England.
Garlock-Walker Machinery Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
R McDougall Co., Galt.
National Automatic Tool Co., Richmond, Indiana
Reed-Prentice Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach. Co., Rockford, Ill.
Silver Mfg. Co., Salem, Ohio.
A R Williams Machinery Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING MACHINES, VERTICAL
Giddings & Lewis Mfg. Co., Fond du Lac, Wis
Lynd-Farquhar Co., Boston, Mass.
Wickes Bros., Saginaw, Mich.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto, Ont.
W. F. & John Barnes Co., Rockford, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Fry's (London), Ltd., London, England.
Garlock-Walker Machinery Co., Toronto, Ont.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
United States Electrical Tool Co., Cincinnati.
Williams & Wilson, Limited, Montreal, Que.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Canada, Walkerville, Ont.
Williams & Wilson, Ltd., Montreal, Que.

ELECTRIC FURNACES
Electric Steel & Metals, Ltd., Welland, Ont.
General Steel Co., Milwaukee, Wis.

ELEVATOR ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton, Ont.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Cleveland Twist Drill Co., Cleveland.
The Geo. F. Foss Mchy. & Supply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Canada, Walkerville, Ont.

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll, Ont.

DRILLS, ELECTRIC AND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
Boker & Co., Inc., H., Montreal, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
United States Electrical Tool Co., Cincinnati.
A. R. Williams Machinery Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Limited, Montreal, Que.

DRILLS, EMERY
Garlock-Walker Machinery Co., Toronto, Ont.

DRILLS, HIGH SPEED TOOL ROOM
Albany Hardware Spec. Co., Albany, Wis.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong, Whitworth of Canada Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal.
H. A. Drury Co., Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal
McKenna Brothers, Pittsburgh, Pa.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass
W. F. & John Barnes Co., Rockford, Ill.
Perfect Machine Co., Galt, Ont.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que
Taylor, J. A. M., Stair Bldg., Toronto.
Whitman & Barnes Mfg. Co., St. Catharines, Ont
Wilt Twist Drill Co of Canada, Walkerville, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Limited, Montreal, Que.

DRILLS, OIL TUBE
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mch. Co., New Bedford, Mass
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Williams & Wilson, Limited, Montreal, Que.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Machinery Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Canada, Walkerville, Ont.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto
The Geo. F. Foss Mchy. & Supply Co., Montreal.
A. R. Williams Machy. Co., Toronto.

DRILLS, TRACK
Cleveland Twist Drill Co., Cleveland.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Canada, Walkerville, Ont.
United Brass & Lead, Ltd., Toronto.

DRINKING FOUNTAINS, SANITARY
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co.
Jones & Glassco, Montreal.
Morse Chain Co., Ithaca, N.Y.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser & Co., S. F., Inc., Fort Wayne, Ind.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sheldons, Ltd., Galt, Ont.

DRUM CONTROLS
Electric Steel & Metals, Ltd., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto
Pratt & Whitney Co., Dundas, Ont.
MacGovern & Co., Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

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Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Williams & Wilson, Limited, Montreal, Que.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Can. Matthews Gravity Carrier Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Williams & Wilson, Limited, Montreal, Que.

EMBOSSING PRESSES
Oliver Machinery Co., Grand Rapids, Mich.

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto
Ford-Smith Machine Co., Hamilton, Ont.

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Baxter & Co., Ltd., J. R., Montreal, Que.
Brantford Emery Wheel Co., Brantford, Canada
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Limited, Montreal, Que.

EMERY WHEEL DRESSINGS
Wheel Trueing Tool Co., Windsor, Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll, Ont.

ENGINES, STEAM, GAS, GASOLINE
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
Sheldons, Ltd., Galt, Ont.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

ENGINE LATHES
Oliver Machinery Co., Grand Rapids, Mich.

ENGINES, MARINE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ENGINE SHAFTS
Hammond Steel Co., Inc., Syracuse, N.Y.

ENGRAVERS
Pritchard-Andrews Co., Ottawa.

ESCUTCHEON PINS
Parmenter & Bulloch Co., Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal
Sheldons, Ltd., Galt, Ont.

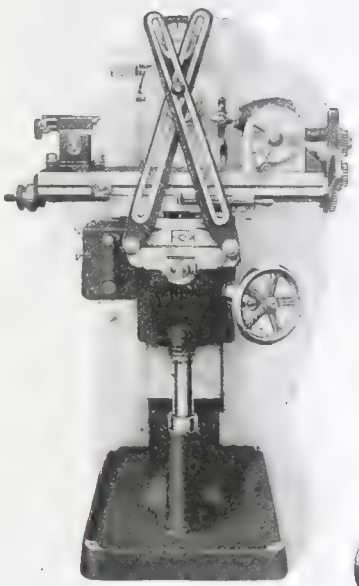
EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Sheldons, Ltd., Galt, Ont.
Williams & Wilson, Limited, Montreal, Que.

TRADE FOX MARK
REGISTERED

MILLING MACHINES

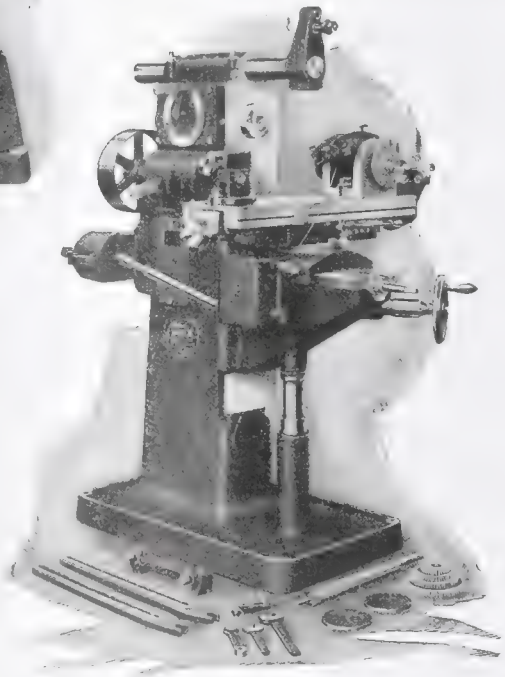
FOR

Rapid Production of Motor Parts



The **demand** for increased production **requires tools** of **great strength** and **durability;** the Fox 2-A Universal Milling Machine illustrated has met this demand, and is being used wherever extreme accuracy and quantity production are required.

The machine has a universal table, spiral cutting attachment, 10″ Dividing Head with 6″ Universal Chuck, making it a machine **especially adapted for Tool Room Work.**



The **United States Government** used this machine in its various **repair shops** for **Aeroplane Motors.**

You should be using this tool to help the production of parts necessary for reconstruction.

Specifications—No. 2-A Miller.

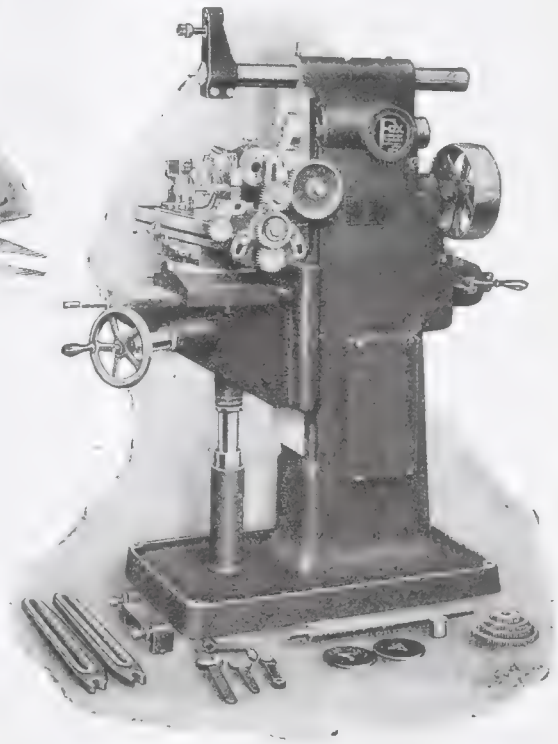
Spindle speeds 12
From 21 to 423 r.p.m.

Table feeds 6
From .317″ to 2.79″ per min.

Table .....8½ x 27″
Long. feed (power) 26″.
Vertical feed (hand) 13″.
Trans. feed (hand) 8½″.

Drive...Single pulley 10 x 3″ running 250 r.p.m.

Gears — Hardened steel.
Weight .....1,500 lbs.



We build this same machine with a plain table, omitting the spiral cutting attachment and Dividing Head.

Our No. 1 type machine has a four-step cone drive, and while being a lighter machine is a "bear" for work. This was proven by **the hundreds of them in the largest munitions plants.**

We also build the Fox Multiple Spindle Drilling Machines.

FOX MACHINE COMPANY

1047 W. Ganson St., Jackson, Michigan, U.S.A.

EXTRUSION DIE STEEL
J. F. A. Comstedt, New York City, N.Y.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EXTRA TOOL STEEL
J. F. A. Comstedt, New York City, N.Y.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.
United Brass & Lead, Ltd., Toronto.

EYE PROTECTORS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.
Williams & Wilson, Limited, Montreal, Que.

FENCE, IRON AND FACTORY
Canada Wire & Iron Goods Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium Alloys Steel Co., Pittsburgh, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.

FILES
Wm. Atkins & Co., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Wilkinson & Kompass, Hamilton, Ont.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser & Co., S. F., Inc., Fort Wayne, Ind.
Canada Wire & Iron Goods Co., Hamilton, Ont.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FIRE BRICKS
Harbison-Walker Refactories Co. of Canada, Montreal, Que.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, Ohio.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ontario.
Toronto Tool Co., Toronto, Ont.

FLEXIBLE SHAFT COILING MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

FLANGING CLAMPS
Wickes Bros., Saginaw, Mich.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener, Ont.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sheldons, Ltd., Galt, Ont.

FORGINGS, STEEL AND IRON
Can. Foundries & Forgings, Ltd., Welland, Ont.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE

FORGING AND WELDING
Victoria Foundry Co., Ottawa.
Can. Billings & Spencer, Ltd., Welland, Ont.
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Williams & Wilson, Limited, Montreal, Que.

FORGINGS, SPECIAL
Armstrong, Whitworth of Canada, Montreal, Que.
Canada Foundries & Forgings, Ltd., Welland, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Henry Hope & Sons of Canada, Ltd., Peterboro.

FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

FOUNTAINS, DRINKING
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Ltd., Montreal.

FUEL OIL SYSTEMS
Bowser & Co., S. F., Inc., Fort Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Chicago Flexible Shaft Co., Chicago, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Mechanical Engineering Co., Three Rivers, Que.
Standard Fuel Engr. Co., Detroit, Mich.
Williams & Wilson, Limited, Montreal, Que.

FURNACES, BLAST
Belleview Industrial Furnace Co., Detroit.
Toronto Iron Works, Ltd., Toronto.

FURNACES, FORGING
Gilbert & Barker Mfg. Co., Springfield, Mass.
Standard Fuel Engineering Co., Detroit, Mich.

FURNACES, HIGH SPEED STEEL, SHELL
Standard Fuel Engineering Co., Detroit, Mich.

FURNACES, LEAD AND SALT
Standard Fuel Engineering Co., Detroit, Mich.

FURNACES, RIVETING
Standard Fuel Engineering Co., Detroit, Mich.

FUSE BOXES, STEEL
Dom. Forge & Stamping Co., Walkerville, Ont.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser & Co., S. F., Inc., Fort Wayne, Ind.

GASOLINE TANKS
Bowser & Co., S. F., Inc., Fort Wayne, Ind.

GASOLINE PUMPS, SELF-MEASURING
Bowser & Co., S. F., Inc., Fort Wayne, Ind.

GAUGES
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGES, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, FUSE HOLE
Windsor Mach. & Tool Co., Windsor, Ont.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.
Toronto Tool Works, Toronto, Ont.
United Brass & Lead, Ltd., Toronto.
Wells Brothers Co. of Canada, Galt, Ont.
Worth Engineering Co., Toronto, Ont.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal, Que.
Dom. Foundries & Steel, Ltd., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto, Ont.
D. E. Whiton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEAR-TURNING MACHINES, BEVEL
Bridgeford Mach. Tool Works, Rochester, N.Y.

GEAR BOXES, REDUCTION
Coventry Chain Co., Coventry, Eng.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.

GEARS, CUT, MORTISE, ANGLE, WORM
Baxter & Co., Ltd., J. R., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Ltd., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Victoria Foundry Co., Ottawa.
Hull Iron & Steel Foundries, Ltd., Hull, Que.
Illinois Tool Works, Chicago, Ill.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Wilson & Co., J. C., Belleville, Ont.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Philadelphia Gear Works, Philadelphia, Pa
A. R. Williams Machy. Co., Toronto.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GENERATORS, ELECTRIC
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Toronto.

GENERATORS, MOTOR
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.
MacGovern & Co., Montreal, Que.

GERMAN SILVER
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland, Ohio.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich.

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland, Ohio.
Willson & Co., Inc., T. A., Reading, Pa.

GOVERNOR, WATER WHEEL
Wilson & Co., J. C., Belleville, Ont.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

GOGGLES
Consolidated Optical Co., Toronto, Ont.
Standard Optical Co., Geneva, N.Y.
Strong, Kenard & Nutt Co., Cleveland, Ohio.
Willson & Co., Inc., T. A., Reading, Pa.
Welding & Supplies Co., Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (SEE LUBRICANTS)

GRINDERS, AUTOMATIC KNIFE
W. H. Banfield & Son, Toronto.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Wisconsin Electric Co., Inc., Racine, Wis.
Blake & Johnson Co., Waterbury, Conn.
Can. Machinery Corp., Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & Supply Co., The Geo. F., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Electrical Tool Co., Cincinnati, O.
Williams & Wilson, Limited, Montreal, Que.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co. Providence, R.I.
Cincinnati Milling Mach. Co., Cincinnati, Ohio.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Greenfield Machine Co., Greenfield, Mass.
Grand Rapids Grinding Mach. Co., Grand Rapids, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Norton Grinding Co., Worcester, Mass.
Perfect Machine Co., Galt, Ont.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Limited, Montreal, Que.

GRINDERS, DIE AND CHASER
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

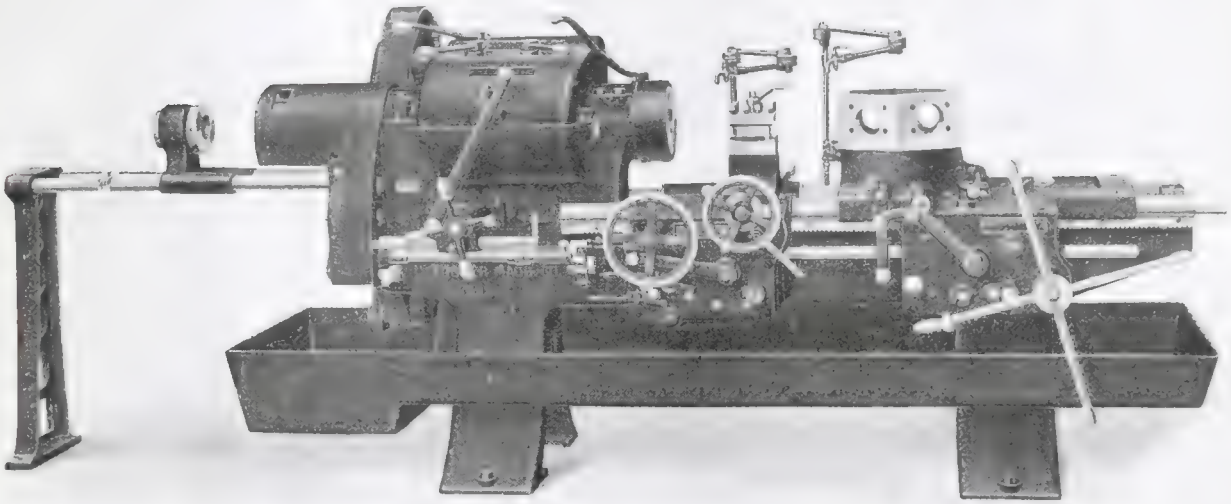
GRINDERS, DRILL
Aikenhead Hardware Co., Toronto, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
United States Electrical Tool Co., Cincinati, O.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Limited, Montreal, Que.

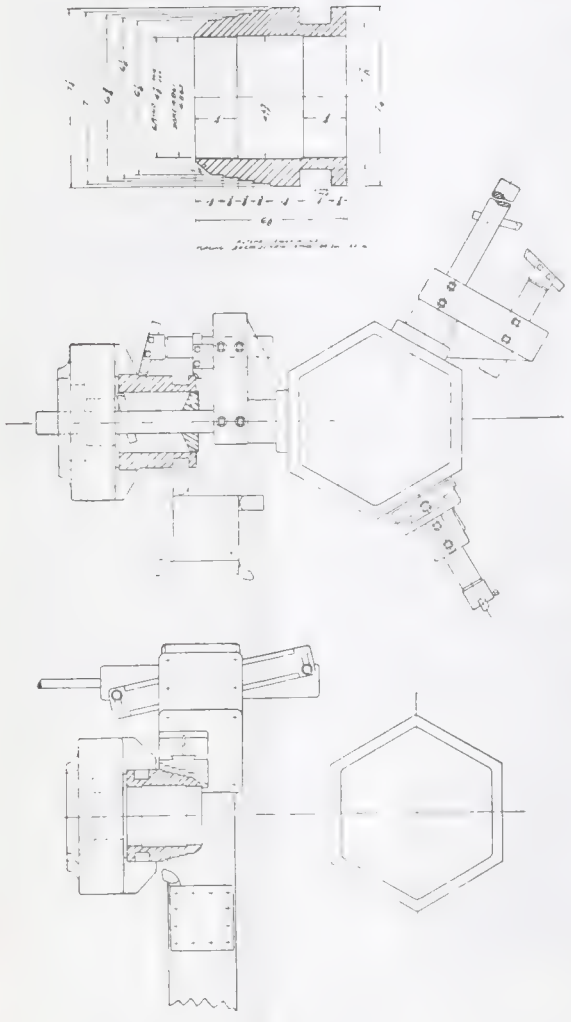
GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.
Perfect Machine Co., Galt, Ont.
Williams & Wilson, Limited, Montreal, Que

GRINDERS, PORTABLE, ELECTRIC, HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Wisconsin Electric Co., Inc., Racine, Wis.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago, Ill.
United States Electrical Tool Co., Cincinati, O.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
MacGovern & Co., Montreal, Que.

THE FOSTER METHOD





Machining an Automatic Chuck Wedge on the Foster 2-B Universal Turret Lathe

The line drawing shows the Foster method of machining a large automatic chuck wedge.

The material used is a hollow forging. This is gripped in a three-jaw scroll chuck. Two cutters carried by a Multiple Turning Head on the hexagon turret, bores and rough turns the piece while a cutter in the square turret on the cross-slide roughs the face.

Next, cutters carried by a second Multiple Turning Head finishes the bore and outside and rounds the corner and a square turret tool finishes the face. A centre on the Multiple Turning Head supports the work, while square turret tools rough and finish the slot. The recess is bored by a cutter in the slide tool on the hexagon turret.

For the second operation the work is gripped by soft jaws in the scroll chuck; a cutter in the square turret in conjunction with the taper attachment removes rapidly all the excess stock. The stepped portion of the wedge is then finished by a forming tool rigidly carried by a holder mounted on the rear end of the cross slide and the automatic wedge is finished.

Trace these operations through again and see how the multiple tooling idea, as applied to this piece of work, saves time—and money.

How about your own work? There are a lot of parts in your factory where multiple tooling can save you time and increase production. Send us your blue prints. Let us study it over and show you how.

THE FOSTER LINE

No. 1-B UNIVERSAL TURRET LATHE
Bar Cap. 2" — Swing over Carriage, 14 — over Cross Slide 8

No. 2-B UNIVERSAL TURRET LATHE
Bar Cap. 3 1/4" — Swing over Carriage, 20 — over Cross Slide, 13 1/2

No. 3-B UNIVERSAL TURRET LATHE
Bar Cap. 4 1/2" — Swing over Carriage, 26 — over Cross Slide, 18 1/4

No. O PLAIN HEAD SCREW MACHINE
Bar Cap. 5/8" — 10" Swing

No. 1 PLAIN HEAD SCREW MACHINE
Bar Cap. 13/16" — 11" Swing

No. 2 PLAIN AND FRICTION HEAD SCREW MACHINES
Bar Cap. 1 1/16" — 13" Swing

No. 3 PLAIN, FRICTION AND ALL GEARED HEAD SCREW MACHINES
Bar Cap. 1 5/16" — 14 1/2" Swing

No. 4 FRICTION HEAD SCREW MACHINE
Bar Cap. 1 7/8" — 17 1/4" Swing

No. 5 FRICTION AND ALL GEARED HEAD SCREW MACHINES
Bar Cap. 1 13/16" — 17 1/4" Swing

Nos. 6, 7, 8, 9, 10 FRICTION HEAD SCREW MACHINES
Bar Cap. 2 5/16"; 2 1/16"; 2 7/8"; 2 1/16"; 3 1/16" resp. — 20" Swing

No. 2 FRICTION HEAD UNIVERSAL TURRET LATHE
Bar Cap. 1 1/16" — 14" Swing

No. 2 FRICTION SET-OVER TURRET LATHE
Bar Cap. 1 5/16" — 14" Swing

No. 3 FRICTION HEAD UNIVERSAL TURRET LATHE
Bar Cap. 1 5/8" — 16" Swing

No. 3 FRICTION HEAD SET-OVER TURRET LATHE
Bar Cap. 1 5/8" — 16" Swing

THREAD MILLERS
Manufactured under the Holden & Morgan Patents

Foster Machine Co., Elkhart, Ind., U. S. A.

GRINDERS, ROTARY SURFACE
Bristol Machine Tool Co., Bristol, Conn.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blake & Johnson Co., Waterbury, Conn.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Ford-Smith Machine Co., Hamilton, Ont.
Grand Rapids Grinding Mach. Co., Grand Rapids, Mich.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Wing & Son, J. E., Hamilton, Ont.

GRINDERS, UNIVERSAL, PLAIN
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.
Williams & Wilson, Limited, Montreal, Que.

GRINDERS, VERTICAL SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Reed-Prentice Co., Worcester, Mass.
Gisholt Machine Co., Madison, Wis.
Norton Grinding Co., Worcester, Mass.
Williams & Wilson, Limited, Montreal, Que.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machinery Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford.
LeBlond Mach. Tool Co., R. K., Cincinnati.
Niles-Bement-Pond Co., New York, N.Y.
Norton Grinding Co., Worcester, Mass.
Wisconsin Electric Co., Racine, Wis.
Williams & Wilson, Limited, Montreal, Que.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Norton Grinding Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Baxter Co., Ltd., J. R., Montreal, Que.
Brantford Emery Wheel Co., Brantford, Canada
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Norton Co., Worcester, Mass.

GRIT, ANGULAR
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ontario.
New Britain Mach. Co., New Britain, Conn.
Page Steel & Wire Co., Adrian, Mich.
Strong, Kennard & Nutt Co., Cleveland, Ohio.

GUN AND AMMUNITION SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

GUN TAPS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baxter & Co., Ltd., J. R., Montreal, Que.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto
Norton, Ralph B., Agent, Montreal.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Fry's (London), Ltd., London, England.
Racine Tool & Machine Co., Racine, Wis.
Plewes, Ltd., Winnipeg, Man.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Ltd., Montreal, Que
Victor Saw Works, Ltd., Hamilton, Canada.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Limited, Montreal, Que.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Limited, Montreal, Que.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Works, Buffalo, N.Y.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
McKenzie Machy. Co., D., Guelph, Ont.
Peerless Machine Co., Racine, Wis.
Perfect Machine Co., Galt, Ont.
Racine Tool & Mach. Co., Racine, Wis.
L. S. Starrett Co., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Williams & Wilson, Limited, Montreal, Que.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Canadian Billings & Spencer Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams & Wilson, Limited, Montreal, Que.

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams & Wilson, Limited Montreal, Que.

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, MARKING
Matthews, Jas. H. & Co., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston Mass.

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAMMERS, SHELL NOSING
Beaudry & Company, Inc., Boston, Mass.

HAND PLANERS
Oliver Machinery Co., Grand Rapids, Mich.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie, Ont.
The Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner, Robt., & Son, Montreal.
Jones & Glassco, Montreal.
Standard Pressed Steel Co., Philadelphia, Pa.
Williams & Wilson, Limited, Montreal, Que.

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

HEATING AND PLUMBING CONTRACTS
James Ballantyne, Montreal.

HEAT TREATMENT OF STEEL
The Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York.

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland, Ohio.

HIGH SPEED STEEL
J. F. A. Comstedt, New York City, N.Y.
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

HIGH SPEED TOOL ROOM DRILLS
Albany Hardware Spec. Co., Albany, Wis.

HIGH SPEED TOOL METAL
Deloro Smelting & Refining Co., Toronto, Ont.
J. F. A. Comstedt, New York City, N.Y.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.
Illinois Tool Works, Chicago, Ill.

HINGES
London Bolt & Hinge Works, London, Ont.

HOBS
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont
Wells Bros. of Can., Galt, Ont.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTING AND CONVEYING MACHINERY AND ENGINES
Can. Link-Belt Co., Toronto, Ont.
Can. Matthews Gravity Carrier Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Quebec.
Jones & Glassco, Montreal.
MacGovern & Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Williams & Wilson, Limited, Montreal, Que

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto, Ont.
Ford Chain Block & Mfg., Philadelphia, Pa.
Independent Pneumatic Tool Co., Chicago, Ill.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Williams & Wilson, Limited, Montreal, Que

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Electric Steels & Metals, Ltd., Welland, Ont.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Williams & Wilson, Limited, Montreal, Que

HOLDERS, STEEL DIE FOR MARKING
Matthews, Jas. H., & Co., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland, Ont

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids, Mich.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Quebec.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, PNEUMATIC
Baxter & Co., Ltd., J. R., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

HYDRAULIC MACHINERY
Garlock-Walker Machinery Co., Toronto, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
William R. Perrin, Ltd., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.
Williams & Wilson, Limited, Montreal, Que

HYDROMETERS
Taylor Instrument Co., Rochester, N.Y.

HYGROMETERS
Taylor Instrument Co., Rochester, N.Y.

HYGRODEIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
L. S. Starrett Co., Athol, Mass.

INDEX CENTRES
Fred C. Dickow, Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Williams & Wilson, Limited, Montreal, Que.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INGOT METAL
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
United Brass & Lead Ltd., Toronto.

INGOTS, STEEL
Nova Scotia Steel & Coal Co., New Glasgow, N.S

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto, Ont.

IRON GREY
Brockville Foundry Co., Brockville, nt.

IRON ORE
Hanna & Co., M. A., Cleveland, O.

IRON SAND
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

IRON, WROUGHT, ROLLED AND PIG
Swedish Steel & Importing Co., Ltd., Montreal.

IRREGULAR CUTTING SHEARS
Quickwork Co., St. Marys, Ohio.

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Williams & Wilson, Limited, Montreal, Que.

JACKS, PNEUMATIC
Northern Crane Works, Walkerville.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.

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The Gray Ball Bearing Co., Ltd., Toronto.

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Brown Engineering Corp., Toronto, Ont.
Elliott & Whitehall Mach. & Tool Co., Galt
Gisholt Machine Co., Madison, Wis.
Homer & Wilson, Hamilton, Ont.
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ont.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Ltd., Welland, Ont

KEY SEATERS
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Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
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Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sheldons, Limited, Galt, Ont.

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LABELS AND TAGS
Matthews, Jas. H. & Co., Pittsburgh, Pa.

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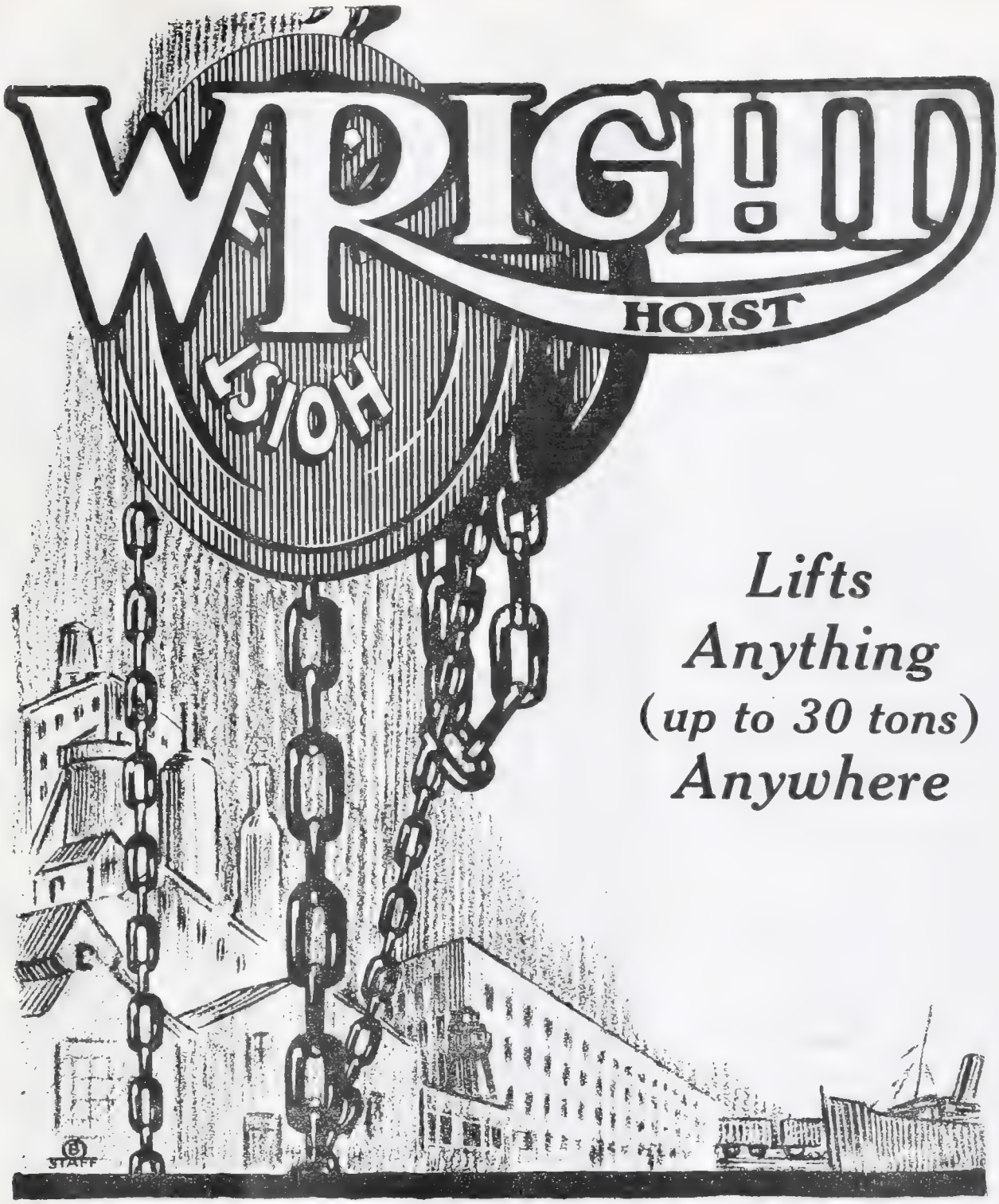
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, Mich.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.



Lifts Anything (up to 30 tons) Anywhere

Wherever there is anything heavier than 50 lbs. and lighter than 30 tons, to be lifted or lowered, whether on land or sea, or in the bowels of the earth, one of three types Wright Hoists will do the work, quicker, better and at less cost.

Wright Hoists are made better; that's why they serve better.

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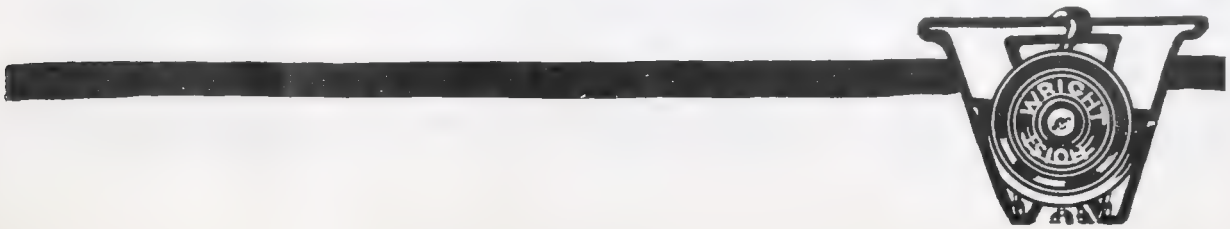

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Wood Turret Machine Co., Brazil, Ind.
Williams & Wilson, Limited, Montreal, Que

LATHE CHUCKS (SEE CHUCKS)

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LATHES, BORING
Bridgeford Mach. Tool Wks., Rochester, N.Y.
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Gisholt Machine Co., Madison, Wis.
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Miles-Bement-Pond Co., New York.
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Whitcomb-Blaisdell Mach. Tool Co., Worcester Mass.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Limited, Montreal, Que

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Wood Turret Machine Co., Brazil, Ind.

LATHES, METAL TURNING
Cisco Machine Tool Co., Cincinnati, Ohio.
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Wood Turret Machine Co., Brazil, Ind.
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Garlock-Walker Machy. Co., Toronto, Ont.
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Garlock-Walker Machy. Co., Toronto, Ont.
Hepburn, John T., Ltd., Toronto.
Roelofson Mach. & Tool Co., Toronto, Can.
W. T. Whitehead, Son & Co., Montreal, Que.
Wood Turret Machine Co., Brazil, Ind.
Williams & Wilson, Limited, Montreal, Que.

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Cisco Machine Tool Co., Cincinnati, Ohio.
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Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Wickes Bros., Saginaw, Mich.
Hepburn, John T., Ltd., Toronto.
Niles-Bement-Pond Co., New York.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
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Wood Turret Machine Co., Brazil, Ind.
Williams & Wilson, Limited, Montreal, Que.

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Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Limited, Montreal Que

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Bliss, E. W., Co., Brooklyn, N.Y.
Williams & Wilson, Limited, Montreal, Que

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Cisco Machine Co., Cincinnati, Ohio.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Williams & Wilson, Limited, Montreal, Que.

LATHES, TURRET, HAND, HORIZONTAL
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram, John, & Sons Co. Dundas Ont.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
H. C. Dodge, Inc., Boston, Mass.
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Ford Smith Machine Co., Hamilton, Ont.
Foster Machine Co. Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn, John T., Ltd., Toronto.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio
Mullmer-Enlund Tool Co., Syracuse, N.Y.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.
Wood Turret Mach. Co., Brazil, Ind., U.S.A.
Williams & Wilson, Limited, Montreal, Que.

LEAD BURNING
St. Lawrence Welding Co., Montreal, Que.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, Mass.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LIFTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

LINK BELTING
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasseo, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Williams & Wilson, Limited, Montreal, Que.

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Bertrams, Ltd., Edinburgh, Scotland.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Williams & Wilson, Limited, Montreal, Que.

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LUBRICATORS
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Peck, Stow & Wilcox Co., Southington, Conn.

MILLING ARBORS
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Baxter & Co., Ltd., J. R., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
The Geo. N. Foss Mchy. & Supply Co., Montreal.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MACHINERY, HAMMER AND NAIL
Garlock-Walker Machinery Co., Toronto, Ont.

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MACHINERY REPAIRS
Marten Mach. Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MACHINERY, MULTI-DRILLING
National Automatic Tool Co., Richmond, Ind.

MACHINERY, TRANSMISSION (POWER)
Morse Chain Co., Ithaca, New York.

MACHINES, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids, Mich.

MACHINES, ROLLING AND BENDING
Stoll Co., Inc., The D. H., Buffalo, N.Y.

MACHINES, RUNNING, BALANCING
Norton Grinding Co., Worcester, Mass.

MACHINES, MULTI-BORING
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Rice Lewis & Son, Toronto, Ont.
MacGovern & Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
J. H. Williams & Co., Brooklyn, N.Y.
Williams & Wilson, Limited, Montreal, Que.

MACHINE TOOLS
Williams & Wilson, Limited, Montreal, Que.

MACHINE & REPETITION WORK
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MANDRELS
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

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Pritchard-Andrews Co. of Canada, Ottawa, Ont.
Matthews, Jas. H., & Co., Pittsburgh, Pa.

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Brown, Boggs Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal
Perrin, Wm. R., Toronto.
Williams & Wilson, Limited, Montreal, Que.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland, Ohio.

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Bowser & Co., S. F., Inc., Fort Wayne, Ind.

MEASURING TAPES AND RULES
James Chesterman & Co., Ltd., Sheffield, Eng.

METALLURGISTS
Toronto Testing Laboratory, Ltd., Toronto.

METAL SAWS
Simonds Mfg. Co., Fitchburg, Mass.
Hoefer Mfg. Co., Freeport, Ill.

METAL SAWS, POWER
Hoefer Mfg. Co., Freeport, Ill.

METALS
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Dom. Iron & Wrecking Co., Ltd., Montreal, Que.
Enushevsky & Son, B., Toronto, Ont.
International Metal & Trading Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Ltd., Montreal, Que.
United Brass & Lead Ltd., Toronto.

METAL STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS
Can. Cartridge Co., Hamilton, Ont.

METERS, WATER
Can. Cartridge Co., Hamilton, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser & Co., Inc., S. F., Toronto, Ont.

MICROMETERS
Almond Mfg. Co., T. E., Ashburnham, Mass.
Taylor, J. A. M., 518 Stair Bldg., Toronto, Ont.
Williams & Wilson, Limited, Montreal, Que.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

MILLING ATTACHMENTS
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Bertram, John, & Sons Co., Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Fox Machine Co., Jackson, Mich.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Taft-Peirce Mfg. Co., Woonsocket, R.I.
Williams & Wilson, Limited, Montreal, Que.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Betts Machine Co., Rochester, N.Y.
Williams & Wilson, Limited, Montreal, Que.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Cleveland Milling Machine Co., Cleveland, O.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Williams & Wilson, Limited, Montreal, Que.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
The Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Limited, Montreal, Que.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Becker Milling Machine Co., Boston, Mass.
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram, John, & Sons Co., Dundas Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
The Geo. F. Foss Mchy. & Supply Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati, Ohio.
Whitney Mfg. Co., Hartford, Conn.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Limited, Montreal, Que.

ARMCO IRON WELDING RODS

cost somewhat more than ordinary filling material, but, compared with the total cost of the weld, the difference is insignificant. The difference in strength and safety of the weld, on the other hand, is of vital importance.

The trade mark ARMCO carries the assurance that iron bearing that mark is manufactured by the American Rolling Mill Company with the skill, intelligence and fidelity associated with its products, and hence can be depended upon to possess in the highest degree the merit claimed for it.

"It has not been difficult to show them the economy of Armco Iron Wire—"

AIR REDUCTION SALES COMPANY

AIRCO

SALES DEPARTMENT 120 BROADWAY NEW YORK April 8th, 1919.

Page Steel & Wire Company
30 Church Street
New York City

Subject Armco Wire - Result of Test.

Dear Sirs

We are more than pleased with the splendid results that we have obtained in our sales campaign of Armco Wire. This product has been offered by us through our local branches located throughout th United States from Seattle to Boston to a large number of our customers, and after thorough tests has been accepted by them in the face of a slightly increased first cost as compared with other products on the market. It has not been difficult to show them the economy of Armco Wire, despite this initial slight increase in its cost.

In this connection we enclose a letter from Mr Walsh of the Newport Shipbuilding Company which we thought might be of interest to you.

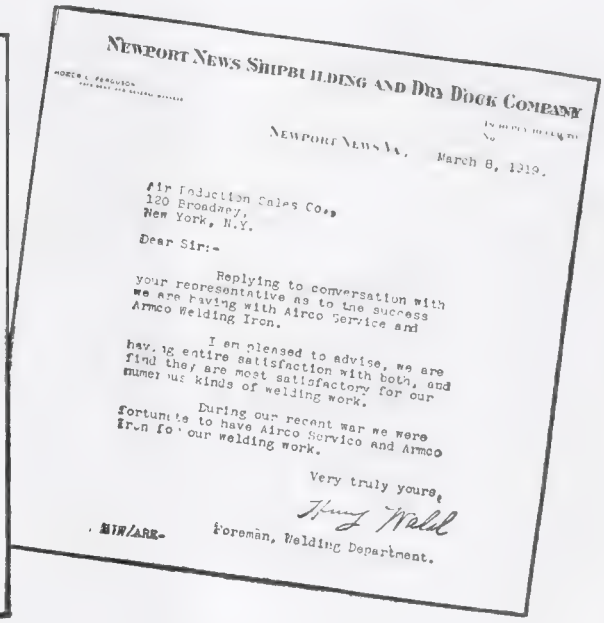
Yours very truly

S [illegible]

Sales Manager
Apparatus Department

SLM-TW

Enclosure



NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

NEWPORT NEWS VA., March 8, 1919.

Air Reduction Sales Co.,
120 Broadway,
New York, N.Y.

Dear Sir:-

Replying to conversation with your representative as to the success we are having with Airco Service and Armco Welding Iron.

I am pleased to advise, we are having entire satisfaction with both, and find they are most satisfactory for our numerous kinds of welding work.

During our recent war we were fortunate to have Airco Service and Armco Iron for our welding work.

Very truly yours,

JW/ARE- Foreman, Welding Department.

The above typical letter to one of our distributors shows that the superiority and real economy of ARMCO welding material are readily appreciated. Welders who use ARMCO IRON exclusively have a big advantage over competitors who buy inferior filler and their customers soon learn the difference.

Another ARMCO advantage from the welder's standpoint is the fact that two kinds of rods of guaranteed ARMCO analysis, one specially treated for electric and the other for oxy-acetylene welding, do all the work (with better results) that heretofore has required a choice of one from many compositions. This means that with a much smaller investment for stock of filling material a shop is fully prepared to handle the usual run of steel and iron welding work.

Because of their exceptional purity and even density Armco Iron Welding Rods flow freely, weld evenly, and give a joint that lends itself perfectly to hammering, forging, and, where necessary, to annealing and quenching.

Our booklet on "Armco Iron Rods and Wire" is full of interesting and useful welding data. Send for it.

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

Makers of "Copperweld" Copper Clad Steel Wire; ARMCO Iron Welding Rods and Electrical Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stockroom Partitions; Architectural Iron.

Plants: Monessen, Pa., and Adrian, Mich.

Sales Offices: 30 Church Street, New York

Pacific Coast Representatives: American Rolling Mill Company, San Francisco
Canadian Distributors: Taylor & Arnold, Ltd., Montreal and Winnipeg.

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MILLING MACHINES, PLAIN, PENCH AND UNIVERSAL
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss, The Geo. F., Mchy. & Supply Co., Montreal.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
R. K. LeBlond Mach. Tool Co., Cincinnati, Ohio
Niles-Bement-Pond Co, New York.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Limited, Montreal, Que.

MILLING MACHINES, PROFILE
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss, The Geo. F., Mchy. & Supply Co., Montreal
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Limited, Montreal, Que.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams & Wilson, Limited, Montreal, Que.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Ltd., Galt, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MODEL WORK
Windsor Mach. & Tool Co., Windsor, Ont.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
The Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.

MOULDS, RUBBER
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.

MULTI-DRILLING MACHINERY, VERTICAL AND HORIZONTAL
The National Automatic Tool Co., Richmond, Ind.

MULTI-BORING MACHINES
The National Automatic Tool Co., Richmond, Ind.

MULTI-TAPPING MACHINERY, VERTICAL AND HORIZONTAL
The National Automatic Tool Co., Richmond, Ind.

MUNTZ METAL
Brown Copper & Brass Roller Mills, New Toronto, Ont.

NAILS
Graham Nail Works (operated by Canada Metal Co., Ltd.), Toronto.
Page Steel & Wire Co., Adrian, Mich.

NAIL SETS
Morrow Screw & Nut Co., John, Ingersoll, Ont.

NAIL MACHINERY
Sleeper & Hartley, Inc., Worcester, Mass.

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pritchard-Andrews Co., Ottawa, Ont.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

NICKEL
Boker & Co., Inc., H., Montreal, Que.

NICKEL SILVER
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

NICKEL STEEL
J. F. A. Comstedt, New York City, N.Y.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

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Curtis & Curtis Co., Bridgeport, Conn.

NIPPLE THREADING MACHINES
John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.
Williams & Wilson, Limited, Montreal, Que.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Morrow Screw & Nut Co., Ltd., John, Ingersoll.
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
United Brass & Lead Ltd., Toronto.
Wilkinson & Kompass, Hamilton, Ont.

NUT BURRING MACHINES
National Machy. Co., Tiffin, Ohio.

NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.
Williams & Wilson, Limited, Montreal, Que.

NUT TAPPERS
Bertram, John, & Sons Co., Dundas Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hall, J. H., & Son, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Williams & Wilson, Limited, Montreal, Que.

OIL SEPARATORS
Can. Fairbanks-Morse, Co., Montreal.
Sheldon's, Ltd., Galt, Ont.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machinery Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser & Co., Inc., S. F., Toronto, Ont.

OPENING DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Can., Toronto

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Brantford Oven & Rack Co., Brantford, Ont.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND UNDER TRUCKS

OXYGEN, ELECTROLYTIC CELLS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford, Ont.

OXY-ACETYLENE WELDING AND CUTTING
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
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Welding & Supplies Co., Montreal, Que.

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Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.

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Cleveland Wire Spring Co., Cleveland.

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Graton & Knight Mfg. Co., Worcester, Mass.
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Frost Mfg. Co., Chicago, Ill.

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Bertrams, Ltd., Edinburgh, Scotland.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
Page Steel & Wire Co., Adrian, Mich.

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Garlock-Walker Machinery Co., Toronto, Ont.

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Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Williams & Wilson, Limited, Montreal, Que.

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Oliver Machinery Co., Grand Rapids, Mich.

PATTERN MAWERS' VISES
Oliver Machinery Co., Grand Rapids, Mich.

PATTERN SHOP SUPPLIES
Oliver Machinery Co., Grand Rapids, Mich.

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Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.
Dominion Pattern Works, Toronto, Ont.
J. C. Wilson & Co., Belleville, Ont.
Greenleafs Ltd., Belleville, Ont.
Marten Machine Co., Hamilton, Ont.

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Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

PECK CARRIERS FOR POWER PLANTS
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Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

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John Morrow Screw & Nut Co., Ingersoll, Ont.

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PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph, Ont.

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Curtis & Curtis Co., Bridgeport, Conn.
Fox Machine Co., Jackson, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Limited, Montreal, Que.

PHOTOSTATS
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Toronto Iron Works, Ltd., Toronto.

PIERCING
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Greenfield Tap & Die Corp., Greenfield, Mass.
John H. Hall & Sons, Ltd., Brantford, Ont.
Wells Bros. Co. of Canada, Galt, Ont.

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Wells Bros. of Can., Galt, Ont.

PIPE DIES
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

PIPE CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

PIPE STOCKS
Greenfield Tap & Die Corp., Greenfield, Mass.
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Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
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PIPE VISES
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Garvin Machine Co., New York.
Hamilton Machine Tool Co., Hamilton, Ohio.
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Williams & Wilson, Ltd., Montreal, Que.
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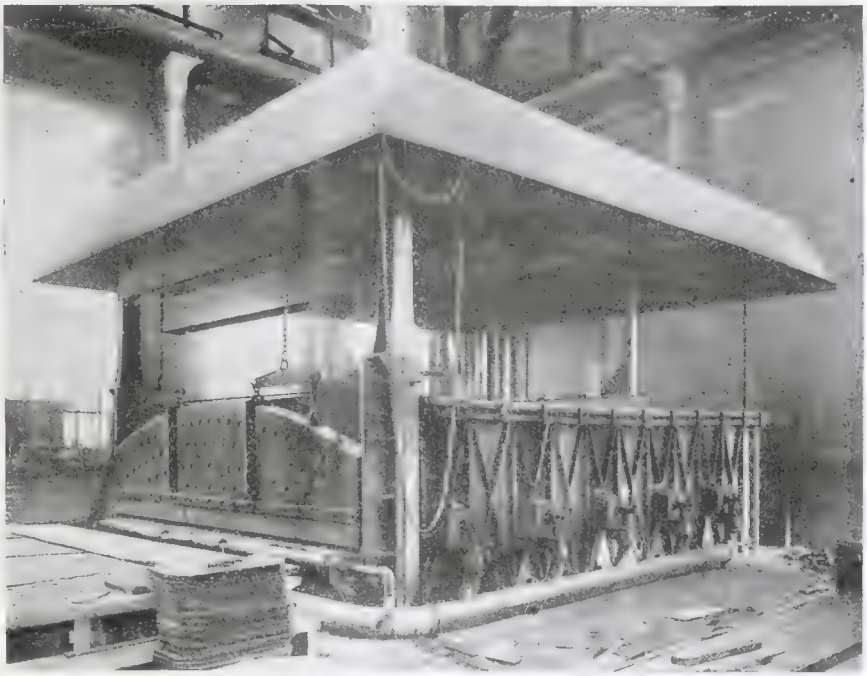

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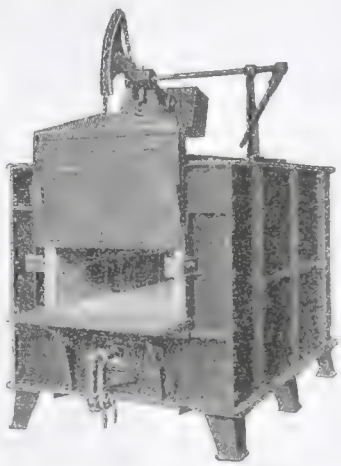

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Stoll Co., Inc., D. H., Buffalo, N.Y.
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Consolidated Press Co., Hastings, Mich.
Garlock-Walker Machinery Co., Toronto, Ont.
William R. Perrin, Ltd., Toronto.
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Toledo Machine & Tool Co., Toledo.
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Williams & Wilson, Limited, Montreal, Que.

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Canada Machinery Corp., Galt, Ont.
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Williams & Wilson, Ltd., Montreal, Que

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Bernard Industrial Co., A., Fortierville, Que.
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Positive Clutch & Pulley Works, Ltd., Toronto
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Johnson, Carlyle, Mach. Co., Manchester, Conn
Williams & Wilson, Limited, Montreal, Que.

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MacKinnon Steel Co,, Sherbrooke, Que.

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Wickes & Co., Saginaw, Mich.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto, Ont.
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Wells Bros. of Can., Galt, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
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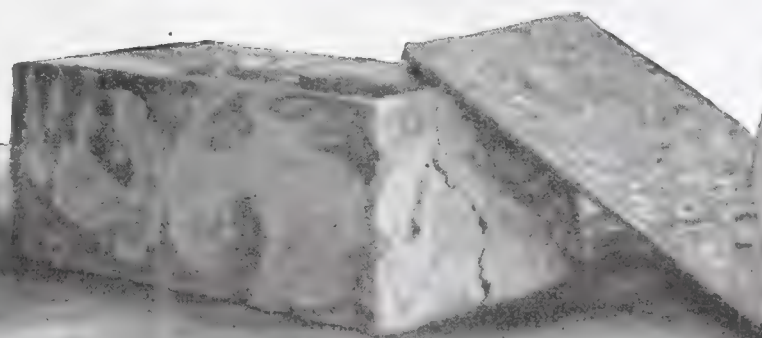

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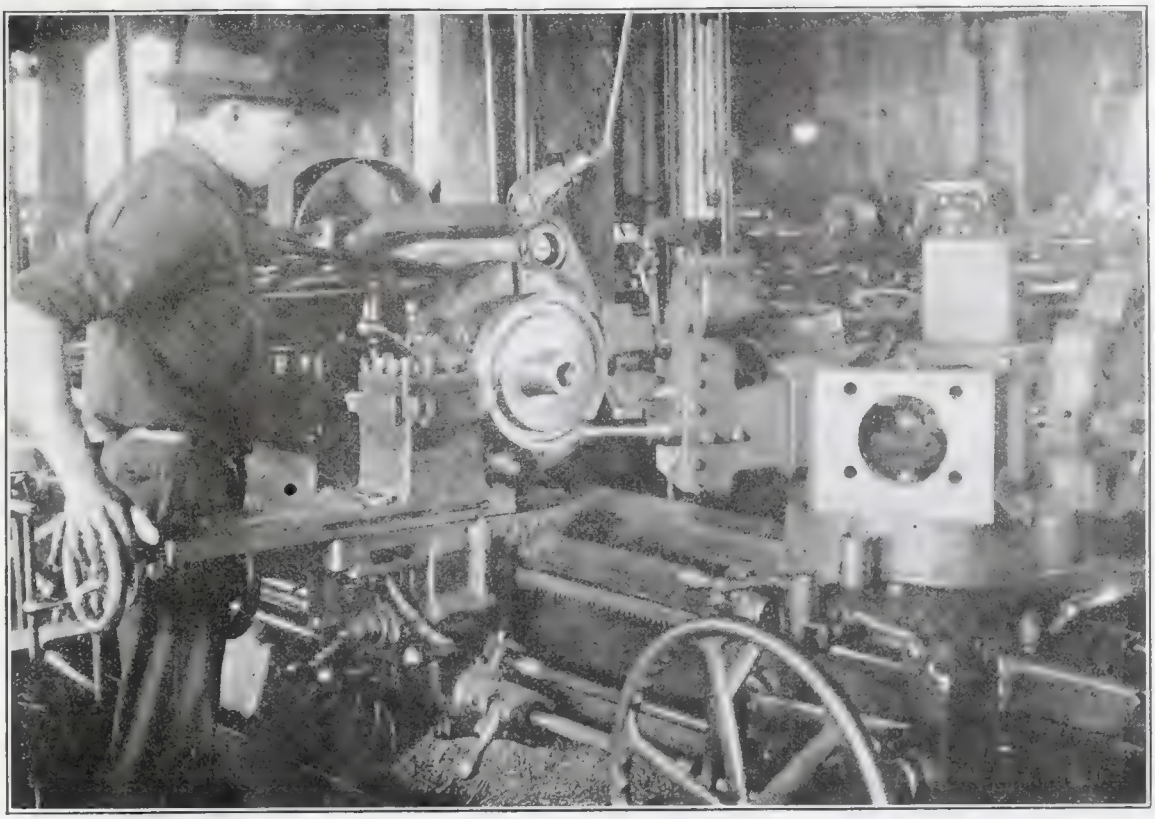

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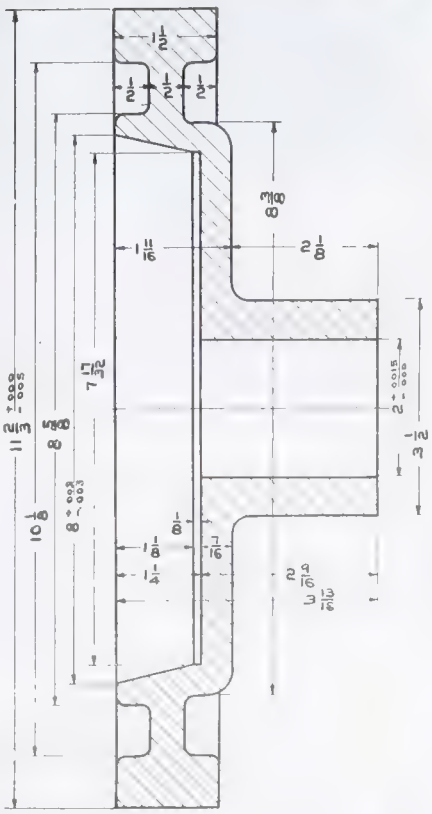

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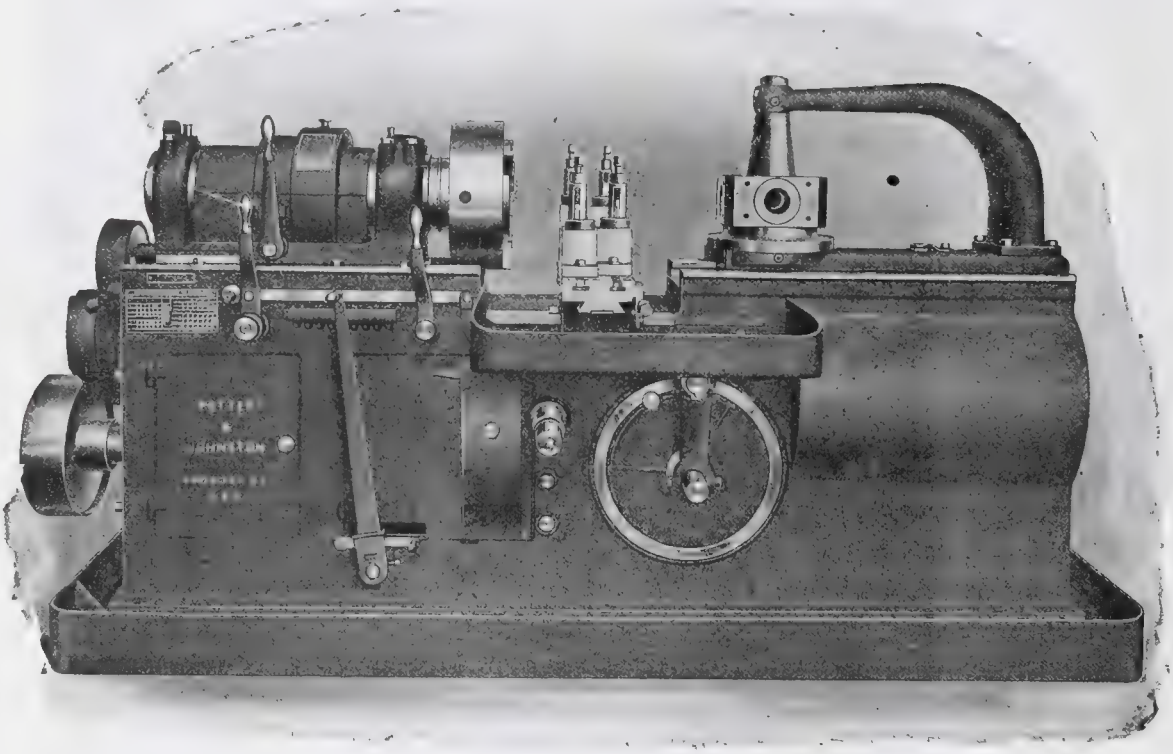

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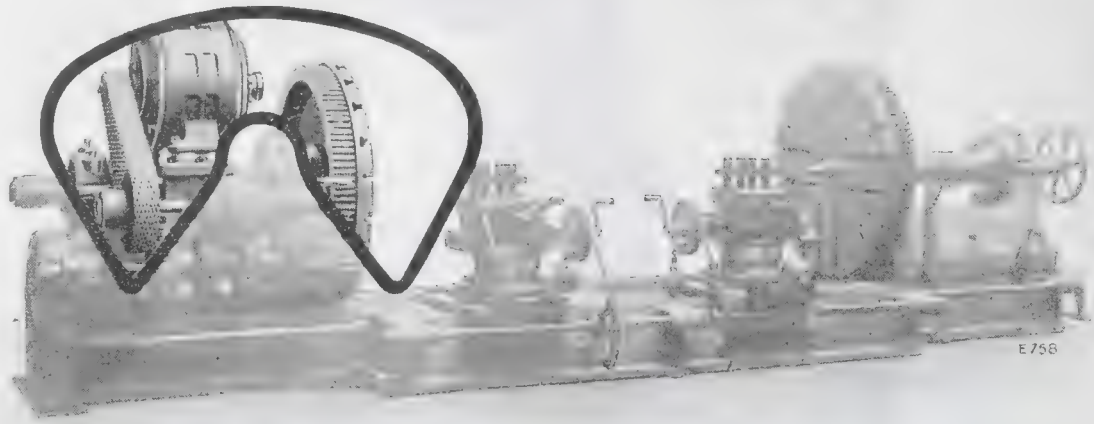

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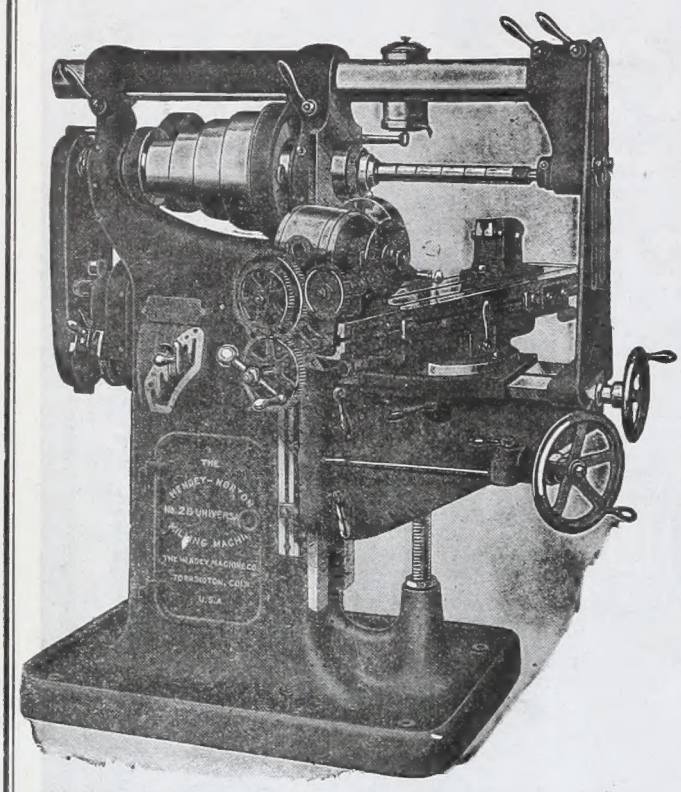

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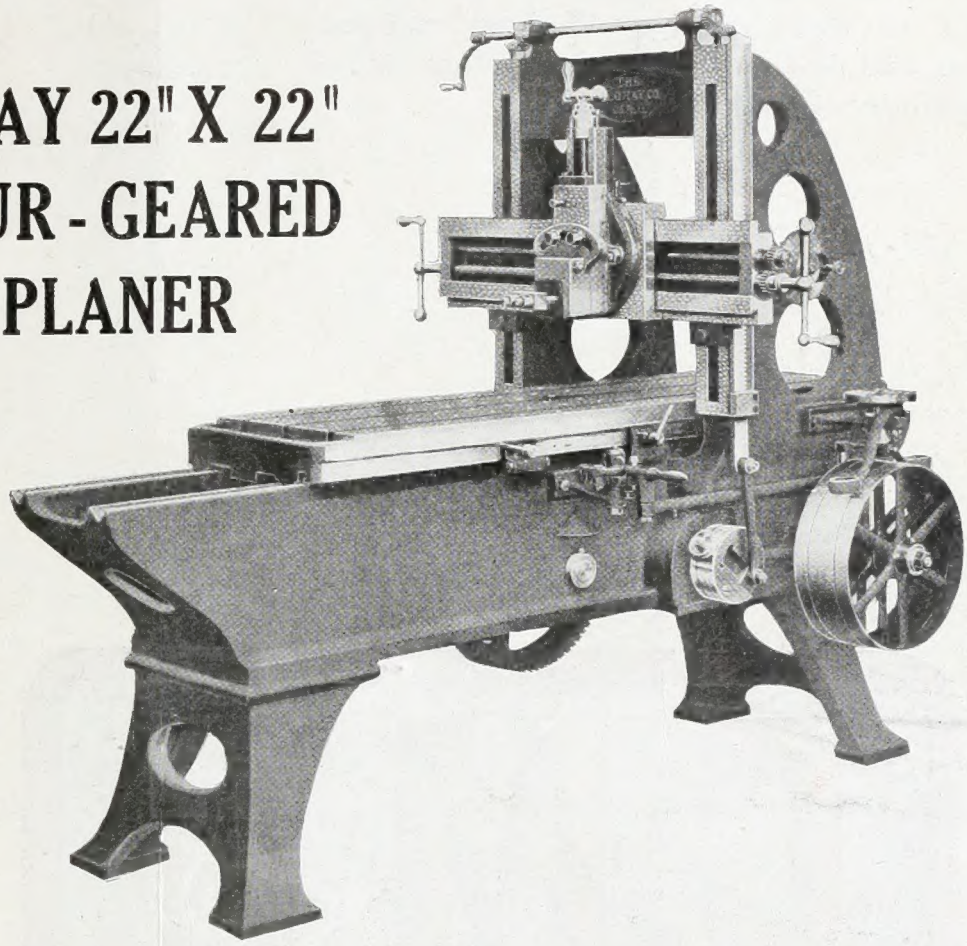

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